



12

PRELIMINARY TABLE OF SOLAR SPECTRUM  
WAVE-LENGTHS

I



PRELIMINARY TABLE  
OF  
SOLAR SPECTRUM WAVE-LENGTHS

BY  
HENRY A ROWLAND

PART I

---

CHICAGO  
The University of Chicago Press  
1896

HA Lib.







## PRELIMINARY TABLE OF SOLAR SPECTRUM WAVE-LENGTHS I

By HENRY A ROWLAND

THE following table of the lines of the solar spectrum has been in course of preparation at the Johns Hopkins University for many years in connection with an investigation of the spectra of the elements. The spectrum of every known element, except gallium (of which I have no specimen), has been photographed in connection with the solar spectrum, and some of these plates have been measured.

The whole solar spectrum has now been measured except the extreme ends, and the wave-lengths have been mostly reduced to my table of standards. Many of the lines, especially the stronger ones, have been identified with respect to the substance producing them, but this must be a labor of years. Hence I have determined to publish the work so far as I have now proceeded, expecting to add to it and correct it for a term of years, until I can publish a standard list of the lines of the solar spectrum with all the elements to which they belong.

The wave-length measurements have been made from my photographs of the solar spectrum, extending at present down to about wave-length 7200, and they will probably not be much changed in the future. The figures in the table refer to the wave-lengths in air at 20°C and 76<sup>cm</sup> of mercury, as they are based upon the table of standards.

The intensities of the solar lines go from 1, a line just clearly visible on my map, up to 1000 for the H and K lines. Below 1 the lines in the order of faintness proceed from 0 to 0000, indicating lines more and more difficult to see.

The ordinary scale from 1 to 10 or from 1 to 6 is far too limited for the spectral lines, especially for the metallic spectra, 1 to 1000 is hardly great enough for the enormous difference in intensity. The small range, 1 to 10, ordinarily used gives an

entirely wrong idea to the worker in this subject, and many books with spectroscopic theories might have been saved by using a scale from 1 to 1000

The expenses of this work have been partly borne by appropriations from time to time by the Bache fund of the National Academy of Sciences, the Rumford fund of the American Academy of Sciences, and the Bruce fund of Harvard College Observatory

The measurement and calculation of wave-lengths have been made most carefully by Mr L E Jewell

My thanks are due to very many friends for assistance in procuring pure and rare elements, etc

The symbols used are as follows A line that is not clearly defined, or that is much weaker than it should be for a line of its breadth, is indicated by an N (such a line may generally be considered as composed of two or more lines too close together to be separated) Two lines close enough together to be considered double are indicated by a d, and a double whose components are very difficult to separate is indicated by d', likewise three lines so close together as to be considered a triplet are indicated by a t

Where several lines are connected by a large brace there is generally shading extending from the center of some strong line to other lines at the extremities of the braces This is the case with the stronger lines of iron and some other elements

In the column devoted to the identification of the solar lines an interrogation mark indicates that the identification of the solar line with the element given is uncertain Where two or more elements are given, the solar line is compound The order in which they are given indicates the portion of the line due to each element, as follows C-Fe-Cr However, it is not always possible to correctly assign the exact positions, and consequently there are probably many errors in the positions assigned Where the solar line is too strong to be due entirely to the element with which it is identified, it is represented thus —Fe, and indicates that the iron line is coincident with the red side of the

solar line, the origin of the rest of the line being unknown. If, as far as can be determined from the plates, two metallic lines coincide exactly with the same portion of a solar line, this is shown by using a comma instead of a dash. Thus Fe, C<sub>1</sub>. In some cases when a double line is particularly difficult to separate, measurements are given on the two components and also on the line unresolved. This last measurement is placed in parenthesis between the other two measurements. Thus

| W L        | INTENSITY |
|------------|-----------|
| 3738.454   | 3         |
| (3738.466) | 6         |
| 3738.505   | 2         |
|            | d         |

means that there is a line at  $w-l$  3738,466 with the intensity 6, and that with good definition this line may be resolved into two components having the intensities 3 and 2 and the given wave-lengths

JOHNS HOPKINS UNIVERSITY,  
Baltimore, Dec 1894

# PRELIMINARY TABLE OF SOLAR SPECTRUM WAVE-LENGTHS XIV<sup>1</sup>

By HENRY A. ROWLAND

| Wave length           | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-----------------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 2975 587              | Cr        | o                       | 2985 999    | Cr?       | ooo                     |
| 2975 766              |           | ooo                     | 2986 109    | Cr        | ooo                     |
| 2976 036              |           | o Na?                   | 2986 239    |           | ooo                     |
| 2976 191              |           | ooo                     | 2986 379    |           | ooo                     |
| 2976 316              |           | ooo                     | 2986 579    | Cr        | o                       |
| 2976 801              |           | ooo                     | 2986 749    |           | oo N                    |
| 2977 021              |           | oo Nd?                  | 2986 999    |           | oooo                    |
| 2977 331              |           | ooo N                   | 2987 169    |           | ooo                     |
| 2978 151              |           | ooo N                   | 2987 289    |           | ooo                     |
| 2978 316              |           | oooo N?                 | 2987 439    | Fe?       | ooo                     |
| 2978 670              |           | ooo N                   | 2987 959    |           | oooo N                  |
| 2979 480              |           | oo                      | 2988 144    |           | oo N                    |
| 2979 670              |           | oooo N                  | 2988 333    |           | ooo N                   |
| 2979 860              |           | o N                     | 2988 598    |           | ooo                     |
| 2980 080              |           | o Nd?                   | 2988 733    | Cr        | oo                      |
| 2980 330              |           | oo                      | 2988 873    |           | ooo                     |
| 2980 490              |           | ooo                     | 2989 038    |           | o N                     |
| 2980 690              |           | oo                      | 2989 298    |           | oo                      |
| 2980 915              |           | o                       | 2989 523    |           | ooo                     |
| 2981 070              |           | oo N                    | 2989 708    |           | i                       |
| 2981 990              |           | ooo N                   | 2989 828    |           | ooo                     |
| 2982 180              |           | oo                      | 2990 008    |           | ooo                     |
| 2982 340              | Ca, Fe?   | ooo N                   | 2990 173    |           | oo                      |
| 2982 530              |           | oo N                    | 2990 438    |           | o                       |
| 2982 885              |           | ooo                     | 2990 523    | Fe?       | i                       |
| 2983 649 <sup>2</sup> |           | oooo N                  | 2990 718    |           | oo                      |
| 2983 764              |           | ooo N                   | 2990 788    |           | ooo                     |
| 2984 414              |           | oooo                    | 2990 968    |           | oo                      |
| 2984 654 <sup>3</sup> |           | oo                      | 2991 203    |           | o                       |
| 2984 849 <sup>3</sup> |           | ooo N d?                | 2991 318    |           | oooo                    |
| 2985 119 <sup>4</sup> |           | ooo N d?                | 2991 538    |           | ooo                     |
| 2985 359              |           | oooo N                  | 2991 738    |           | oo                      |
| 2985 439              |           | oooo N                  | 2992 188    |           | ooo Nd?                 |
| 2985 629              |           | ooo                     | 2992 488    |           | oooo                    |

<sup>1</sup>When the publication of the table was commenced in the first volume of this JOURNAL, the calculations of wave lengths in the extreme ultra violet was not completed. These wave lengths will be published in this and subsequent numbers of the JOURNAL.

<sup>2</sup>Strong line of iron at 2983 689. The strong *shaded* lines of iron and some other elements are with difficulty seen in the faint beginning of the ultra violet solar spectrum, and as a consequence their intensities are much less than in corresponding metallic spectra.

<sup>3</sup>Violet portion of line partly due to a line of overlapping yellow.

<sup>4</sup>Red portion of line partly due to a line of overlapping yellow.

| Wave length           | Substance                       | Intensity and Character | Wave-length           | Substance           | Intensity and Character |
|-----------------------|---------------------------------|-------------------------|-----------------------|---------------------|-------------------------|
| 2992 693              | Ni                              | 0                       | 3002 433              | Ni<br>Fe,<br>, Fe   | 000                     |
| 2992 828              |                                 | 0000                    | 3002 593              |                     | 00                      |
| 2993 027              |                                 | 000                     | 3002 743              |                     | 00                      |
| 2993 177              |                                 | 000                     | 3003 102              |                     | 0 N                     |
| 2993 327              |                                 | 000                     | 3003 182              |                     | 1 N                     |
| 2993 457              |                                 | 000                     | 3003 312              |                     | 000                     |
| 2993 807              |                                 | 0000                    | 3003 572              |                     | 0 Nd?                   |
| 2993 927              |                                 | 00                      | 3003 773 <sup>1</sup> |                     | 2 Nd?                   |
| 2994 177              |                                 | 00                      | 3003 962              |                     | 00                      |
| 2994 327              |                                 | 000 N                   | 3004 230              |                     | 00                      |
| 2994 527 s            | Fe, Ni<br>Ca<br>Cr, Co          | 000                     | 3004 572              | Cr<br>Fe?,<br>, Co? | 000                     |
| 2995 057 s            |                                 | 000                     | 3004 732              |                     | 1                       |
| 2995 212              |                                 | 00                      | 3004 912              |                     | 000 N                   |
| 2995 347              |                                 | 000                     | 3005 160 s            |                     | 3                       |
| 2995 597              |                                 | 00                      | 3005 407 s            |                     | 3                       |
| 2995 767 <sup>3</sup> |                                 | 00                      | 3005 572              |                     | 000 Nd?                 |
| 2995 937              |                                 | 000                     | 3005 852              |                     | 2 d                     |
| 2996 096              |                                 | 2                       | 3006 059              |                     | 0                       |
| 2996 187              |                                 | 000                     | 3006 262 <sup>2</sup> |                     | 0 Nd?                   |
| 2996 347              |                                 | 0000                    | 3006 482              |                     | 000 Nd?                 |
| 2996 495              | , Fe?<br>Co?, Cr                | 2                       | 3006 677              | Ca<br>, Fe<br>Fe    | 0 Nd?                   |
| 2996 689              |                                 | 1                       | 3006 982 s            |                     | 0                       |
| 2996 940              |                                 | 1                       | 3007 237 s            |                     | 1 N                     |
| 2997 067              |                                 | 000                     | 3007 405 s            |                     | 1 Nd?                   |
| 2997 317              |                                 | 00                      | 3007 592              |                     | 00 N                    |
| 2997 437 s            |                                 | 2                       | 3007 757              |                     | 00                      |
| 2997 602              |                                 | 000                     | 3007 862              |                     | 000                     |
| 2997 787              |                                 | 00 N d?                 | 3008 072              |                     | 000                     |
| 2998 066              |                                 | 0                       | 3008 212 s            |                     | 00                      |
| 2998 266              |                                 | 00                      | 3008 312              |                     | 00                      |
| 2998 451              | Cr                              | 0                       | 3008 582              | Fe<br>Mn?           | 00                      |
| 2998 606              |                                 | 00                      | 3008 744              |                     | 00 N                    |
| 2998 776              |                                 | 000                     | 3008 914              |                     | 0 Nd?                   |
| 2998 916              |                                 | 2                       | 3009 022              |                     | 00                      |
| 2999 136              |                                 | 0000                    | 3009 190              |                     | 0000                    |
| 2999 286              |                                 | 00                      | 3009 302 s            |                     | 1                       |
| 2999 603 s            |                                 | 00 N                    | 3009 462              |                     | 1                       |
| 2999 748 s            |                                 | 0                       | 3009 642 s            |                     | 00                      |
| 2999 923              |                                 | 000                     | 3009 822              |                     | 2 N                     |
| 3000 043              |                                 | 000                     | 3010 277              |                     | 1 N                     |
| 3000 178              | Fe,<br>Co,<br>Ni?, Ca<br>Cr, Fe | 00                      | 3010 522              | Mn?                 | 0                       |
| 3000 458              |                                 | 00                      | 3010 731              |                     | 00                      |
| 3000 553              |                                 | 00                      | 3011 257              |                     | 0                       |
| 3000 693              |                                 | 00                      | 3011 390              |                     | 00 N                    |
| 3000 913              |                                 | 000                     | 3011 527              |                     | 00                      |
| 3001 103 s            |                                 | 00 Nd                   | 3011 597              |                     | 00                      |
| 3001 373              |                                 | 00 Nd                   | 3011 747              |                     | 1 N                     |
| 3001 763              |                                 | 000                     | 3011 832              |                     | 000                     |
| 3002 093              |                                 | 000 N                   | 3011 907              |                     | 00                      |
| 3002 288              |                                 | 000                     | 3012 146 <sup>2</sup> |                     | 00 N                    |
|                       |                                 |                         |                       | Ni,                 | 5 d?                    |

<sup>1</sup> Red portion of line partly due to a line of overlapping yellow<sup>2</sup> Violet portion of line partly due to a line of overlapping yellow<sup>3</sup> Very strong shaded non lines

| Wave length             | Substance       | Intensity and Character | Wave length              | Substance          | Intensity and Character |
|-------------------------|-----------------|-------------------------|--------------------------|--------------------|-------------------------|
| 3012 247                |                 | ooo N                   | 3020 936                 |                    | ooo N                   |
| 3012 557 s              |                 | 2                       | 3021 170 <sup>a3</sup> s | Fe                 | 3                       |
| 3012 707                |                 | ooo                     | 3021 346                 |                    | ooo N                   |
| 3012 827                |                 | ooo N                   | 3021 516                 |                    | oooo N                  |
| 3013 037                |                 | o                       | 3021 676                 | Cl                 | 1                       |
| 3013 169                | Cl <sup>2</sup> | 1                       | 3021 821                 |                    | oooo N                  |
| 3013 227                |                 | o                       | 3022 001                 |                    | ooo N                   |
| 3013 437                |                 | oo Nd <sup>2</sup>      | 3022 216                 |                    | oooo Nd <sup>2</sup>    |
| 3013 691                | Co              | oo                      | 3022 371                 |                    | oo                      |
| 3013 840                | Cl              | 1                       | 3022 476                 | Co                 | o                       |
| 3014 067                |                 | ooo                     | 3022 693                 |                    | 1                       |
| 3014 215 s              |                 | o                       | 3022 861                 | Mn                 | 1                       |
| 3014 282 s              |                 | 1                       | 3023 011                 |                    | oooo                    |
| 3014 427                |                 | oo                      | 3023 178 <sup>a</sup>    |                    | 2 N                     |
| 3014 552                |                 | ooo N                   | 3023 416                 |                    | ooo                     |
| 3014 752                | Mn <sup>2</sup> | ooo                     | 3023 559                 |                    | oo N                    |
| 3014 878                |                 | 1                       | 3023 796                 |                    | ooo N                   |
| 3015 049                | Cl              | 1                       | 3023 984                 |                    | o Nd <sup>2</sup>       |
| 3015 300                | Cr              | 2                       | 3024 156 s               | Fe                 | 4 Nd <sup>2</sup>       |
| 3015 467                |                 | ooo                     | 3024 326                 |                    | ooo                     |
| 3015 617                |                 | 2                       | 3024 465 s               | Cr                 | 4                       |
| 3015 799                | Co              | ooo                     | 3024 756                 |                    | ooo Nd <sup>2</sup>     |
| 3015 917                |                 | ooo                     | 3024 908                 |                    | 1                       |
| 3016 047                | Fe <sup>2</sup> | 2                       | 3025 095                 |                    | 1 Nd <sup>2</sup>       |
| 3016 300 s              | Fe,             | 4 Nd                    | 3025 385 s               |                    | 3                       |
| 3016 557                | Mn <sup>2</sup> | oo                      | 3025 571                 |                    | oooo N                  |
| 3016 622                |                 | oo <sup>b</sup>         | 3025 737                 | -, Fe <sup>2</sup> | 2 N                     |
| 3016 869                |                 | 2                       | 3025 961 s               | Fe                 | 2 N                     |
| 3016 957                |                 | 1                       | 3026 131                 |                    | oo N                    |
| 3017 127                |                 | oooo                    | 3026 331                 |                    | ooo N                   |
| 3017 308                | Li <sup>2</sup> | 1                       | 3026 486                 | Co                 | o                       |
| 3017 361                | Co <sup>2</sup> | o                       | 3026 591                 | Fe,                | 3                       |
| 3017 516                |                 | o                       | 3026 761                 |                    | 2                       |
| 3017 691                | Co, Cr          | 1 Nd <sup>2</sup>       | 3026 931                 |                    | 1                       |
| 3017 786 s              | Fe,             | 1 N                     | 3027 069                 |                    | o                       |
| 3017 961                |                 | oo                      | 3027 141                 |                    | o                       |
| 3018 086                |                 | ooo N                   | 3027 291 s               | Fe                 | ooo N                   |
| 3018 248                |                 | 1                       | 3027 481                 |                    | ooo N                   |
| 3018 361                |                 | oo                      | 3027 717                 |                    | o                       |
| 3018 601                | Cl,             | 2                       | 3027 811                 |                    | 1                       |
| 3018 919                | Cr              | 1                       | 3027 999                 |                    | ooo N                   |
| 3019 078 s              | , Fe            | 1 N                     | 3028 128 <sup>a</sup>    |                    | 3                       |
| 3019 271                | Ni              | 1 N                     | 3028 243                 |                    | 1                       |
| 3019 426                |                 | 1                       | 3028 403                 |                    | oo                      |
| 3019 666                |                 | oo <sup>no</sup>        | 3028 561                 |                    | oo Nd <sup>2</sup>      |
| 3019 986                |                 | oo N                    | 3028 716                 |                    | o                       |
| 3020 106                |                 | o N                     | 3028 806                 |                    | o                       |
| 3020 346                |                 | ooo N                   | 3028 980                 |                    | 1                       |
| 3020 606 <sup>3</sup> s | Fe              | oo N                    | 3029 134                 |                    | 1 Nd <sup>2</sup>       |
| 3020 826 <sup>3</sup> s | Cr, Fe          | oo Nd <sup>2</sup>      | 3029 261                 | Cl                 | 1                       |

<sup>a</sup>Violet portion of line partly due to a line of overlapping yellow<sup>3</sup>Very strong shaded iron lines

# TABLE OF SOLAR SPECTRUM WAVE-LENGTHS

11

| Wave-length | Substance | Intensity and Character | Wave-length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3029 369    | Fe?       | 5                       | 3037 510 5  | Fe        | 10 N                    |
| 3029 441    |           | 0 N                     | 3037 685    |           | 0                       |
| 3029 661    |           | 000                     | 3037 895    |           | 0                       |
| 3029 835    | Li?       | 4                       | 3038 050    | Ni        | 3                       |
| 3029 936    |           | 000                     | 3038 210    |           | 1                       |
| 3030 091    |           | 1                       | 3038 423    | Co?       | 2                       |
| 3030 261    | Fe        | 3                       | 3038 625    |           | 1                       |
| 3030 356    | Cl        | 2                       | 3038 860    |           | 3                       |
| 3030 591    |           | 000                     | 3039 095    |           | 1                       |
| 3030 720    |           | 1                       | 3039 170    |           | 2                       |
| 3030 881    |           | 000 N                   | 3039 309    |           | 0000                    |
| 3031 046    |           | 1                       | 3039 433    |           | 2                       |
| 3031 161    |           | 0                       | 3039 660    |           | 0                       |
| 3031 312    | Fe        | 1                       | 3039 721    | Co,       | 2                       |
| 3031 454    | Co, Cl    | 1                       | 3039 883    | Cl        | 2                       |
| 3031 591    | Cr?       | 00 N                    | 3040 030    |           | 0000                    |
| 3031 741    | Fe        | 1                       | 3040 130    |           | 000                     |
| 3031 821    |           | 1                       | 3040 340    |           | 0000                    |
| 3031 975    | -, Ni?    | 3                       | 3040 435    |           | 1                       |
| 3032 141    |           | 0000                    | 3040 550    | Fe        | 3                       |
| 3032 336    |           | 000 N d'                | 3040 712    | Mn        | 1                       |
| 3032 567    |           | 1                       | 3040 865    |           | 0                       |
| 3032 741    |           | 0000                    | 3040 950    | Cl        | 2                       |
| 3032 971    |           | 0000                    | 3041 060    |           | 2                       |
| 3033 026    |           | 3                       | 3041 145    |           | 0                       |
| 3033 211    |           | 2                       | 3041 325    | Mn?       | 00 N                    |
| 3033 321    |           | 0000                    | 3041 532    |           | 0 Nd?                   |
| 3033 532    |           | 5                       | 3041 740    | Fe        | 2                       |
| 3033 718    |           | 0                       | 3041 867    | Fe        | 2                       |
| 3033 918    |           | 2                       | 3042 005    |           | 00                      |
| 3034 036    |           | 000                     | 3042 150    | Fe        | 3                       |
| 3034 166    |           | 00                      | 3042 365    |           | 0                       |
| 3034 304    | Cl        | 2                       | 3042 592    | Co        | 0                       |
| 3034 558    | Co,       | 2                       | 3042 765    | Fe        | 3                       |
| 3034 669    |           | 3                       | 3042 957    |           | 0                       |
| 3034 911    |           | 00                      | 3043 239    |           | 0                       |
| 3035 098    |           | 0                       | 3043 456    | Mn?       | 1                       |
| 3035 341    |           | 0                       | 3043 648    |           | 1                       |
| 3035 468    |           | 1                       | 3043 870    | Mn?       | 0000                    |
| 3035 581    |           | 000 N                   | 3043 970    |           | 1                       |
| 3035 847 5  |           | 5                       | 3044 112 5  | Co        | 3                       |
| 3036 001    |           | 00                      | 3044 220    |           | 000                     |
| 3036 215    | Ca?       | 0                       | 3044 345    |           | 0                       |
| 3036 370    |           | 00                      | 3044 442    |           | 0000                    |
| 3036 505    |           | 0                       | 3044 671 5  | Mn        | 3                       |
| 3036 625    |           | 00                      | 3045 100    | -, Ni     | 3 } d                   |
| 3036 880    |           | 1 Nd?                   | 3045 183    | Fe        | 4 } d                   |
| 3037 085    |           | 00                      | 3045 440    |           | 000 N                   |
| 3037 160    | Cr        | 2                       | 3045 560    |           | 0000 N                  |
| 3037 330    |           | 1 N                     | 3045 695    | Mn,       | 3                       |



| Wave length  | Substance        | Intensity and Character | Wave length           | Substance           | Intensity and Character |
|--------------|------------------|-------------------------|-----------------------|---------------------|-------------------------|
| 3045 870     | ,Mn?             | 2 N                     | 3053 856              |                     | 1                       |
| 3046 025     |                  | 0000                    | 3053 988              | C <sub>1</sub>      | 3                       |
| 3046 150     |                  | 0                       | 3054 429              | Mn, N <sub>1</sub>  | 10                      |
| 3046 375     |                  | 00                      | 3054 807              | ,Co                 | 1                       |
| 3046 610     |                  | 00                      | 3054 931              |                     | 0                       |
| 3046 778 s   | T <sub>1</sub> , | 5                       | 3055 051              | Z <sub>1</sub>      | 0                       |
| 3046 919     |                  | 0                       | 3055 233              |                     | 0                       |
| 3047 041     |                  | 1                       | 3055 374              | Fe                  | 4                       |
| 3047 158     | Mn               | 1                       | 3055 428              |                     | 2                       |
| 3047 311     |                  | 0                       | 3055 563              |                     | 0                       |
| 3047 471     |                  | 0 N                     | 3055 701              |                     | 0000                    |
| 3047 725 s   | Fe               | 20 N                    | 3055 814 } s          |                     | 2                       |
| 3047 911     |                  | 1 Nd?                   | 3055 861              |                     | 0                       |
| 3048 151     | ,Co              | 0 Nd?                   | 3056 021              |                     | 0000 N                  |
| 3048 327     |                  | 1                       | 3056 221              |                     | 0                       |
| 3048 449     |                  | 000                     | 3056 339              |                     | 1                       |
| 3048 563     |                  | 3                       | 3056 441              |                     | 1                       |
| 3048 701     |                  | 000 Nd?                 | 3056 691              |                     | 0                       |
| 3048 893     |                  | 1                       | 3056 861              | T <sub>1</sub>      | 2                       |
| 3048 999     | Mn, Co           | 2                       | 3056 901              |                     | 1                       |
| 3049 124     |                  | 0                       | 3057 117              |                     | 00 N                    |
| 3049 261     |                  | 00                      | 3057 257              |                     | 1                       |
| 3049 462     |                  | 3                       | 3057 382              |                     | 00                      |
| 3049 649     |                  | 2                       | 3057 552 s            | T <sub>1</sub> , Fe | 20                      |
| 3049 856     |                  | 000 N d                 | 3057 753              | N <sub>1</sub>      | 2                       |
| 3050 001     |                  | 000 N                   | 3057 907              |                     | 1 N                     |
| 3050 186 } s |                  | 2                       | 3058 072              |                     | 00                      |
| 3050 231 } s |                  | 4                       | 3058 189              | T <sub>1</sub>      | 4                       |
| 3050 374     |                  | 0000                    | 3058 457              |                     | 1                       |
| 3050 501     |                  | 0000                    | 3058 605              |                     | 1                       |
| 3050 623     | Co               | 000                     | 3058 812              |                     | 0                       |
| 3050 771     |                  | 1                       | 3059 012              |                     | 1 N                     |
| 3050 943     | N <sub>1</sub>   | 5                       | 3059 212 s            | Fe                  | 20                      |
| 3051 156     |                  | 1                       | 3059 377              |                     | 0                       |
| 3051 351     |                  | 0000                    | 3059 482              |                     | 0                       |
| 3051 528     |                  | 2 N                     | 3059 616              |                     | 2                       |
| 3051 721     |                  | 000 N                   | 3059 845              | T <sub>1</sub>      | 3                       |
| 3051 896     |                  | 00                      | 3060 137              | ,Co                 | 1                       |
| 3052 091     |                  | 000 N                   | 3060 192              |                     | 00                      |
| 3052 256     |                  | 00                      | 3060 337              |                     | 00                      |
| 3052 331     | Cr?              | 0                       | 3060 450              |                     | 1                       |
| 3052 396     |                  | 0                       | 3060 552              |                     | 1                       |
| 3052 591     |                  | 1                       | 3060 652              | Fe?                 | 1                       |
| 3052 694     |                  | 0                       | 3060 727              |                     | 1                       |
| 3052 891     |                  | 0                       | 3060 878              |                     | 2                       |
| 3053 031     |                  | 00                      | 3061 093 s            | Fe?                 | 3                       |
| 3053 173 s   | Fe               | 4                       | 3061 259 <sup>1</sup> |                     | 00 N                    |
| 3053 341     |                  | 000 N                   | 3061 487              | Z <sub>1</sub>      | 00 N                    |
| 3053 530 s   |                  | 7 d?                    | 3061 682              |                     | 0                       |
| 3053 764     |                  | 0                       | 3061 772              | C <sub>1</sub> ?    | 00                      |

<sup>1</sup> Red portion of line partly due to a line of overlapping yellow

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3061 931 s  | Co        | 3                       | 3069 288    |           | 2                       |
| 3062 082    |           | 00                      | 3069 441    |           | 1                       |
| 3062 222    | Mn        | 1                       | 3069 562    |           | 2                       |
| 3062 358    | Co,-      | 4 N                     | 3069 788    |           | 1                       |
| 3062 622    |           | 00                      | 3070 022    |           | 1                       |
| 3062 795    |           | 00                      | 3070 145    |           | 0                       |
| 3062 969    |           | 3d?                     | 3070 372    | Mn        | 3                       |
| 3063 152    |           | 0000                    | 3070 487    |           | 00                      |
| 3063 282    |           | 1                       | 3070 599    |           | 1                       |
| 3063 348    |           | 3                       | 3070 802    |           | 0                       |
| 3063 512    | Cu        | 000                     | 3070 902    |           | 0                       |
| 3063 612    |           | 2                       | 3071 112    |           | 00                      |
| 3063 662    |           | 3                       | 3071 252    |           | 1                       |
| 3063 836    |           | 2                       | 3071 360    | Ti        | 3                       |
| 3063 912    |           | 00                      | 3071 542    |           | 00                      |
| 3064 043    | Fe?       | 2                       | 3071 662    | -,Ba      | 00                      |
| 3064 122    |           | 1                       | 3071 784    |           | 0                       |
| 3064 323    |           | 2                       | 3071 905    |           | 00                      |
| 3064 475    | Co        | 1                       | 3072 072    | Co        | 1                       |
| 3064 622    |           | 000                     | 3072 222    | li        | 3                       |
| 3064 729    | Ni        | 3                       | 3072 289    |           | 0                       |
| 3064 802    |           | 1                       | 3072 435    | Co        | 3                       |
| 3064 936    |           | 1                       | 3072 602    |           | 1                       |
| 3065 062    |           | 1                       | 3072 777    |           | 000                     |
| 3065 201    | Cr?       | 2                       | 3073 091    | li,       | 6 Nd?                   |
| 3065 423    |           | 1                       | 3073 232    | Mn,       | 1                       |
| 3065 602    |           | 0000                    | 3073 342    |           | 2                       |
| 3065 722    |           | 00                      | 3073 477    |           | 0000                    |
| 3065 882    |           | 0000 Nd?                | 3073 632    | Co        | 00                      |
| 3066 101    | -,Mn      | 2                       | 3073 784    | Cr        | 1                       |
| 3066 251    |           | 0                       | 3073 939    | Cu,-      | 0                       |
| 3066 334    | Ti        | 2                       | 3074 104    | Fe?       | 1                       |
| 3066 471    | Ti        | 1                       | 3074 262    | Fe?       | 2                       |
| 3066 608    | Ti, Fe?   | 2                       | 3074 492    |           | 1                       |
| 3066 793    |           | 000                     | 3074 542    | Fe?       | 2                       |
| 3066 923    |           | 000                     | 3074 803    |           | 0                       |
| 3067 101    | Fe?       | 1                       | 3075 012    |           | 000 N                   |
| 3067 230    | Fe        | 2                       | 3075 142    |           | 000                     |
| 3067 369 s  | Fe        | 8                       | 3075 212    |           | 0                       |
| 3067 493    |           | 1 N                     | 3075 346 s  | Ti        | 3                       |
| 3067 764    |           | 1                       | 3075 462    |           | 0                       |
| 3067 895    |           | 1                       | 3075 562    |           | 0000                    |
| 3068 046    |           | 2                       | 3075 702    |           | 0 N                     |
| 3068 283    | Fe        | 2                       | 3075 840 s  | Fe        | 3                       |
| 3068 388    |           | 1                       | 3076 002    |           | 1                       |
| 3068 583    |           | 1                       | 3076 105    |           | 1                       |
| 3068 705    |           | 1                       | 3076 372    |           | 0                       |
| 3068 832    |           | 1                       | 3076 542    |           | 1                       |
| 3068 903    |           | 0                       | 3076 692    |           | 0000                    |
| 3069 053    |           | 00                      | 3076 857    |           | 0                       |

| Wave length | Substance | Intensity and Character | Wave length | Substance    | Intensity and Character |
|-------------|-----------|-------------------------|-------------|--------------|-------------------------|
| 3076 938    |           | 0                       | 3083 957    |              | 00                      |
| 3077 134    |           | 0                       | 3084 162    |              | 00                      |
| 3077 295 s  | l e       | 3                       | 3084 272    |              | 0000                    |
| 3077 332 s  |           | 1                       | 3084 397    |              | 000                     |
| 3077 502    |           | 0000 Nd?                | 3084 562    |              | 0                       |
| 3077 665    |           | 0                       | 3084 682    | Cl?          | 00                      |
| 3077 747    |           | 1                       | 3084 792    |              | 0000                    |
| 3077 842    | Fe?       | 0                       | 3084 902    |              | 0000                    |
| 3077 942    | Cr        | 0                       | 3085 004    |              | 1                       |
| 3078 151 s  | Fe?       | 4 d?                    | 3085 150    |              | 0                       |
| 3078 359    |           | 0                       | 3085 313    |              | 2                       |
| 3078 494    |           | 2                       | 3085 438    | Fe?          | 1                       |
| 3078 552    | Fe        | 3                       | 3085 502    |              | 1                       |
| 3078 769 s  | li,       | 8 d?                    | 3085 652    |              | 0000                    |
| 3078 932    |           | 000                     | 3085 780    |              | 1                       |
| 3079 022    |           | 00                      | 3085 827    |              | 1                       |
| 3079 212    |           | 000 Nd?                 | 3085 972    |              | 000                     |
| 3079 415    |           | 00                      | 3086 102    |              | 000 N                   |
| 3079 482    | Co        | 0 N                     | 3086 217    |              | 000                     |
| 3079 724 s  | Mn        | 2                       | 3086 335    |              | 0                       |
| 3079 862    |           | 0000                    | 3086 503    | Co           | 1                       |
| 3079 932    |           | 000                     | 3086 636    |              | 2                       |
| 3080 086    | Fe?       | 4                       | 3086 742    |              | 00                      |
| 3080 223    | Fe?       | 1                       | 3086 893 s  | Co           | 4                       |
| 3080 352    |           | 0                       | 3087 094    |              | 000                     |
| 3080 475    |           | 1                       | 3087 182 s  | Li           | 1                       |
| 3080 529    |           | 00                      | 3087 451    |              | 1                       |
| 3080 702    |           | 00                      | 3087 559    |              | 0                       |
| 3080 864 s  | ,Ni       | 5                       | 3087 639    | Cl?          | 000                     |
| 3080 984    | Cd        | 00                      | 3087 799    |              | 00                      |
| 3081 112    |           | 1                       | 3087 949    | Co           | 0 Nd?                   |
| 3081 354    |           | 2                       | 3088 145 s  | li           | 7 d?                    |
| 3081 419    | Mn,       | 3                       | 3088 294    |              | 0 N                     |
| 3081 567    |           | 0                       | 3088 461    |              | 1                       |
| 3081 657    |           | 1                       | 3088 716    |              | 00                      |
| 3081 787    |           | 1                       | 3088 858    |              | 2                       |
| 3081 832    |           | 1                       | 3088 929    |              | 0000                    |
| 3081 947    |           | 0                       | 3089 106    |              | 0                       |
| 3082 142    | Mn?       | 1                       | 3089 202    |              | 000                     |
| 3082 275 s  | Al        | 5                       | 3089 509    | li           | 1                       |
| 3082 632    |           | 00                      | 3089 614    |              | 00                      |
| 3082 734    | Co        | 2                       | 3089 719    | Co           | 3                       |
| 3082 957    | Co        | 00 N                    | 3089 851    |              | 2                       |
| 3083 149    |           | 1                       | 3089 974    |              | 2                       |
| 3083 275    |           | 1                       | 3090 328    | li?, Fe?, Co | 1 N                     |
| 3083 389    |           | 1                       | 3090 480    |              | 1                       |
| 3083 489    |           | 00                      | 3090 592    |              | 0                       |
| 3083 610    |           | 0                       | 2090 839    |              | 00                      |
| 3083 727    |           | 00                      | 3090 974    |              | 0                       |
| 3083 859 s  | l e       | 4                       | 3091 177    | ,Mg          | 4                       |

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3091 319    |           | 1 N                     | 3097 935    |           | 000                     |
| 3091 477    |           | 1                       | 3098 070    |           | 000                     |
| 3091 689    | Fe        | 4                       | 3098 177    |           | 0                       |
| 3091 799    |           | 00                      | 3098 298    | Fe, Co    | 2                       |
| 3091 976    |           | 0                       | 3098 430    |           | 0000                    |
| 3092 199    |           | 0                       | 3098 560    |           | 000                     |
| 3092 339    |           | 0000                    | 3098 693    |           | 2                       |
| 3092 509    |           | 1                       | 3098 825    |           | 000                     |
| 3092 579    |           | 00                      | 3098 930    |           | 00                      |
| 3092 704    |           | 0000                    | 3099 073    |           | 00                      |
| 3092 818 s  | Al        | 4                       | 3099 220    | Ni,       | 2                       |
| 3092 957 s  | Al        | 1                       | 3099 340    | Zi        | 0                       |
| 3093 089    | Mg        | 1                       | 3099 523    |           | 1                       |
| 3093 229    |           | 2 N                     | 3099 680    |           | 0 N                     |
| 3093 452    | Fe        | 1                       | 3099 780    | Co        | 000                     |
| 3093 604    |           | 0                       | 3099 895    |           | 000                     |
| 3093 714    |           | 00                      | 3100 001 }  | Fe        | 3                       |
| 3093 829    |           | 000                     | 3100 092 }  | Fe        | 3                       |
| 3093 929    | Fe        | 1                       | 3100 255    |           | 00 N                    |
| 3093 989    |           | 1                       | 3100 430 s  | Fe, Mn    | 4 N                     |
| 3094 049    | Fe, Cu?   | 000                     | 3100 629    |           | 000                     |
| 3094 174    |           | 0000                    | 3100 787 s  | Fe, li    | 3                       |
| 3094 311    |           | 1                       | 3100 944    | Fe, Co?   | 1                       |
| 3094 401    |           | 1                       | 3101 047    |           | 0                       |
| 3094 470    |           | 00                      | 3101 117    | Fe        | 1                       |
| 3094 575    |           | 00                      | 3101 347    |           | 1                       |
| 3094 732 s  |           | 2                       | 3101 522    |           | 00 N                    |
| 3094 830    |           | 0000                    | 3101 679 s  | Ni        | 4 N                     |
| 3095 003 s  | Fe?       | 4                       | 3101 799    |           | 00 N                    |
| 3095 190    |           | 0                       | 3102 000 s  | Ni        | 3                       |
| 3095 360    | Fe        | 2                       | 3102 079    |           | 00 N                    |
| 3095 453    |           | 3                       | 3102 253    |           | 1                       |
| 3095 660    |           | 00 N                    | 3102 404    | V         | 3                       |
| 3095 830    | Co        | 00 Nd?                  | 3102 474    | , Co      | 2                       |
| 3095 990    | Cr,       | 0                       | 3102 624    |           | 0000                    |
| 3096 145    |           | 1                       | 3102 748    |           | 0                       |
| 3096 244    |           | 2                       | 3102 869    |           | 00                      |
| 3096 430    |           | 0                       | 3102 987    | Fe        | 1                       |
| 3096 510    | Co        | 0                       | 3103 084    |           | 0                       |
| 3096 655    | Ci?       | 000                     | 3103 214    |           | 0000 Nd?                |
| 3096 730    |           | 0                       | 3103 389    |           | 0                       |
| 3096 870    | Co,-      | 000 N                   | 3103 454    |           | 1                       |
| 3097 008    | , Mg      | 5                       | 3103 599    |           | 00                      |
| 3097 235    | Ni        | 2                       | 3103 719    |           | 0000                    |
| 3097 282    | li        | 1                       | 3103 886    | Co, Fe?   | 2                       |
| 3097 460    |           | 000                     | 3103 924    | li, Fe?   | 3                       |
| 3097 538    |           | 00                      | 3104 087    | , Co      | 00                      |
| 3097 595    |           | 00                      | 3104 269    |           | 0                       |
| 3097 723    |           | 00                      | 3104 379    |           | 0000                    |
| 3097 890    |           | 1                       | 3104 454    |           | 00                      |

| Wave length | Substance          | Intensity and Character | Wave length | Substance            | Intensity and Character |
|-------------|--------------------|-------------------------|-------------|----------------------|-------------------------|
| 3104 676    |                    | 2 N                     | 3112 183    | Fe, Ti?              | 2                       |
| 3104 819    |                    | 00                      | 3112 320    |                      | 1 N                     |
| 3104 884    |                    | 0000                    | 3112 575    | Ti?                  | 00                      |
| 3105 019    |                    | 00                      | 3112 715    |                      | 0000                    |
| 3105 199    | I <sub>1</sub>     | 2                       | 3112 790    |                      | 00                      |
| 3105 279    |                    | 1                       | 3112 910    |                      | 0000                    |
| 3105 429    |                    | 0000                    | 3113 060    |                      | 00                      |
| 3105 569    | ,Ni                | 2                       | 3113 203    |                      | 00                      |
| 3105 668    |                    | 1                       | 3113 320    |                      | 0000                    |
| 3105 782    |                    | 1                       | 3113 490    |                      | 1                       |
| 3105 999    | Co?                | 0000 N                  | 3113 560    | Co                   | 0                       |
| 3106 137    |                    | 2                       | 3113 698    | Fe?                  | 1                       |
| 3106 346    | Ti                 | 3                       | 3113 773    |                      | 0                       |
| 3106 661    | Zr                 | 2                       | 3113 945    |                      | 0 N                     |
| 3106 914    | Ti                 | 000                     | 3114 185    | I <sub>1</sub> ?     | 1                       |
| 3107 012    |                    | 1                       | 3114 232    | ,Ni                  | 3                       |
| 3107 197    | Co,                | 00 N                    | 3114 423    |                      | 2                       |
| 3107 427    |                    | 0                       | 3114 460    |                      | 1                       |
| 3107 561    |                    | 0                       | 3114 590    |                      | 0000                    |
| 3107 670    |                    | 1                       | 3114 735    |                      | 00                      |
| 3107 830    | Ni?                | 0                       | 3114 780    |                      | 0                       |
| 3107 959    |                    | 00                      | 3114 885    |                      | 1                       |
| 3108 089    | Fe?                | 1                       | 3115 150 s  | Fe                   | 1 N                     |
| 3108 239    |                    | 0000 N                  | 3115 390    |                      | 0                       |
| 3108 369    |                    | 00 N                    | 3115 460    |                      | 0                       |
| 3108 469    |                    | 0000                    | 3115 575    |                      | 0                       |
| 3108 661    | Cu?                | 00                      | 3115 670    |                      | 00                      |
| 3108 787    |                    | 0                       | 3115 775    |                      | 1                       |
| 3108 991    |                    | 0                       | 3115 990    |                      | 0                       |
| 3109 057    |                    | 1                       | 3116 160    |                      | 0000 N                  |
| 3109 179    |                    | 1                       | 3116 370    | Fe?                  | 1                       |
| 3109 339    | ,Cl                | 3                       | 3116 500    |                      | 0                       |
| 3109 609    | Co                 | 00                      | 3116 610    | Fe?                  | 1                       |
| 3109 729    |                    | 1                       | 3116 741    | Fe                   | 2                       |
| 3109 909    |                    | 0000                    | 3116 835    |                      | 1                       |
| 3110 031    |                    | 00                      | 3117 025    |                      | 0                       |
| 3110 190    | Co,                | 1                       | 3117 090    |                      | 1                       |
| 3110 351    | Fe?                | 5 Nd?                   | 3117 145    |                      | 00                      |
| 3110 635    |                    | 00                      | 3117 309    |                      | 1                       |
| 3110 810    | I <sub>1</sub> , V | 5 Nd?                   | 3117 357    |                      | 0                       |
| 3110 955    | Co, Fe?            | 2                       | 3117 540    | I <sub>1</sub> ?     | 00 N                    |
| 3111 000    | Cl, Zr             | 1                       | 3117 770    | I <sub>1</sub> , Fe? | 2                       |
| 3111 180    |                    | 0000                    | 3117 877    |                      | 1                       |
| 3111 285    |                    | 00                      | 3117 998    |                      | 2                       |
| 3111 410    | Co?                | 00 N                    | 3118 249    | I <sub>1</sub> ?     | 1                       |
| 3111 530    |                    | 0000                    | 3118 360    | Co                   | 0                       |
| 3111 640    |                    | 0000                    | 3118 498    | V                    | 3                       |
| 3111 791    | Fe?                | 1                       | 3118 665    |                      | 00                      |
| 3111 920    | Fe?                | 2                       | 3118 764    | Cl,                  | 2                       |
| 3112 050    |                    | 00                      | 3118 935    |                      | 0                       |

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3119 144    |           | 00                      | 3126 319    | V, Fe     | 5                       |
| 3119 307    | -,Cl      | 1 Nd?                   | 3126 444    |           | 000                     |
| 3119 460    |           | 00                      | 3126 584    |           | 00                      |
| 3119 613    | Fe        | 3                       | 3126 729    |           | 1                       |
| 3119 787    | Ti?, Cr   | 1                       | 3126 879    | Co        | 1                       |
| 3119 911    | Ti        | 1                       | 3126 959    |           | 0                       |
| 3120 121    |           | 00 N                    | 3127 159    |           | 00                      |
| 3120 201    |           | 0000                    | 3127 229    |           | 0000                    |
| 3120 346    |           | 1                       | 3127 359    | Fe?, Co   | 0                       |
| 3120 481    | -,Cl      | 3                       | 3127 474    |           | 0                       |
| 3120 539    | Fe        | 2                       | 3127 604    |           | 0                       |
| 3120 711    |           | 000                     | 3127 784    |           | 2 d?                    |
| 3120 841    | Zr        | 0                       | 3127 959    |           | 1                       |
| 3120 986    | Fe?       | 1                       | 3128 199    |           | 0 N                     |
| 3121 191    |           | 0000                    | 3128 402    |           | 1                       |
| 3121 270 s  | V         | 4                       | 3128 499    |           | 0                       |
| 3121 529    | Co        | 1                       | 3128 634    |           | 0                       |
| 3121 714    | Co,       | 3                       | 3128 819    | Cl,       | 2                       |
| 3121 893    |           | 1                       | 3128 889    |           | 00                      |
| 3121 969    |           | 00                      | 3129 010    | Fe?       | 1                       |
| 3122 079    |           | 00                      | 3129 120    | Co        | 000                     |
| 3122 192    |           | 0                       | 3129 220    | Fe?       | 1                       |
| 3122 329    |           | 0                       | 3129 290    | Zi        | 0                       |
| 3122 427    | Fe?       | 1                       | 3129 433    | Fe, Ni    | 3                       |
| 3122 680    |           | 2                       | 3129 645    | Co,       | 00 N                    |
| 3122 774    |           | 00                      | 3129 880 s  | Zi        | 0                       |
| 3122 894    |           | 0000                    | 3130 060    |           | 00 N                    |
| 3123 019    |           | 0                       | 3130 250    |           | 00 N                    |
| 3123 059    |           | 00                      | 3130 380    | V         | 3                       |
| 3123 203    | li        | 0                       | 3130 529    |           | 1                       |
| 3123 371    |           | 00                      | 3130 681    |           | 1                       |
| 3123 460    | Fe?       | 0                       | 3130 745    | Be?       | 0                       |
| 3123 554    |           | 00                      | 3130 909    | Ti,-      | 3                       |
| 3123 672    |           | 1                       | 3131 169    | Be?       | 1 N                     |
| 3123 809    |           | 0000                    | 3131 350    | Cr,-      | 0                       |
| 3123 889    | li?       | 00 N                    | 3131 475    |           | 0                       |
| 3124 070    |           | 1                       | 3131 560    |           | 0                       |
| 3124 208    | Fe?       | 0                       | 3131 640    |           | 0                       |
| 3124 394    |           | 000 N                   | 3131 822    |           | 0                       |
| 3124 599    |           | 00                      | 3131 920    |           | 000                     |
| 3124 749    |           | 00                      | 3132 065    |           | 000                     |
| 3124 799    |           | 000                     | 3132 169    | ,Cr       | 4                       |
| 3124 914    |           | 00                      | 3132 303    | ,Co       | 0                       |
| 3125 029    |           | 2                       | 3132 402    | Mn?       | 0                       |
| 3125 109    | Cr,       | 4                       | 3132 635    | Fe?       | 2                       |
| 3125 164    |           | 2                       | 3132 749    | Mo        | 1                       |
| 3125 399    |           | 5                       | 3132 935    | Cl,       | 00 N                    |
| 3125 579    | Cr?       | 00                      | 3133 180    |           | 1                       |
| 3125 779    | Fe, V     | 5                       | 3133 330    | Cd, Zr    | 1                       |
| 3126 029    | Zr        | 0                       | 3133 449    | V         | 2                       |

# PRELIMINARY TABLE OF SOLAR SPECTRUM WAVE-LENGTHS XV

By HENRY A. ROWLAND

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3133 605    | Zr        | 0                       | 3138 901    |           | 0                       |
| 3133 790    |           | 000 N                   | 3139 031    |           | 0                       |
| 3134 080    |           | 00 Nd?                  | 3139 221    |           | 000                     |
| 3134 230 s  | Ni, Fe    | 8                       | 3139 279    |           | 2                       |
| 3134 451    |           | 1                       | 3139 421    |           | 0                       |
| 3134 510    |           | 1                       | 3139 601    |           | 00                      |
| 3134 655    |           | 000                     | 3139 781    |           | 1                       |
| 3134 740    |           | 00                      | 3139 876    |           | 1                       |
| 3134 830    |           | 00                      | 3140 052    | Fe?, Co   | 5                       |
| 3135 051    | V,        | 2                       | 3140 131    |           | 0000                    |
| 3135 160    |           | 000                     | 3140 324    |           | 0                       |
| 3135 295    |           | 000                     | 3140 503    | Fe?       | 2                       |
| 3135 470    | Fe?       | 1                       | 3140 626    |           | 000                     |
| 3135 567    | Fe?       | 1                       | 3140 872 s  | Co,-      | 3                       |
| 3135 703    |           | 0                       | 3141 053    |           | 000 N                   |
| 3135 821    | Fe?       | 2                       | 3141 221    |           | 00                      |
| 3135 985    | Fe?       | 1                       | 3141 296    |           | 0                       |
| 3136 130    |           | 00                      | 3141 411    |           | 00                      |
| 3136 200    |           | 000                     | 3141 628    | ,Li?      | 0                       |
| 3136 310    |           | 0                       | 3141 781    | Ti?       | 00                      |
| 3136 460    |           | 00                      | 3141 916    |           | 0000                    |
| 3136 621    | Fe?       | 2                       | 3142 023    |           | 2                       |
| 3136 705    |           | 0                       | 3142 136    |           | 000                     |
| 3136 822    | Cr, Co    | 3                       | 3142 271    |           | 000                     |
| 3137 005    |           | 1                       | 3142 339    |           | 0                       |
| 3137 140    | Zr        | 0                       | 3142 585    | Fe, Cu?   | 5                       |
| 3137 215    |           | 000                     | 3142 626    |           | 000                     |
| 3137 445 s  | Co        | 3                       | 3142 791    |           | 000                     |
| 3137 560    | Co        | 000                     | 3142 846    | Mn        | 00                      |
| 3137 675    |           | 00                      | 3143 012    | Fe        | 2                       |
| 3137 825    |           | 00                      | 3143 131    |           | 1                       |
| 3137 880    | Co        | 0                       | 3143 271    |           | 00                      |
| 3138 011    |           | 00                      | 3143 357    | Fe?       | 1                       |
| 3138 120    |           | 00                      | 3143 451    |           | 0000                    |
| 3138 191    |           | 00                      | 3143 601    |           | 2 N                     |
| 3138 321    | (1?)      | 000                     | 3143 690    |           | 1 N                     |
| 3138 421    |           | 0000                    | 3143 879    | I1        | 4                       |
| 3138 521    |           | 000                     | 3144 011    |           | 0                       |
| 3138 633    | Fe?       | 2                       | 3144 111    | Fe        | 2                       |
| 3138 798    | Zr        | 1                       | 3144 231    |           | 0                       |

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3144 351    |           | 0                       | 3150 947    | Co?       | 0000                    |
| 3144 441    |           | 0                       | 3151 120    |           | 1                       |
| 3144 568    |           | 1                       | 3151 212    |           | 0000                    |
| 3144 616    | Fe?       | 1                       | 3151 352    |           | 1 N                     |
| 3144 744    |           | 0                       | 3151 467    | Fe        | 2                       |
| 3144 852    | Ti?       | 1                       | 3151 632    |           | 0000                    |
| 3144 931    |           | 000                     | 3151 757    |           | 000                     |
| 3145 040    |           | 0                       | 3151 978    | Fe?       | 1                       |
| 3145 206    | Co, Fe    | 3                       | 3152 115    |           | 1                       |
| 3145 251    |           | 2                       | 3152 232    |           | 0                       |
| 3145 484    |           | 3                       | 3152 377    | Li,       | 5                       |
| 3145 641    |           | 0                       | 3152 572    |           | 00                      |
| 3145 840    | Ni,       | 2                       | 3152 712    |           | 0000                    |
| 3145 906    |           | 1                       | 3152 852    | Co,-      | 1 Nd?                   |
| 3146 091    | Zr        | 1                       | 3152 972    | Ci?       | 000                     |
| 3146 221    |           | 000                     | 3153 072    |           | 0                       |
| 3146 371    |           | 1                       | 3153 173    |           | 00                      |
| 3146 416    |           | 0                       | 3153 306    | Fe        | 3                       |
| 3146 581    |           | 0                       | 3153 434    | Fe?       | 1                       |
| 3146 713    |           | 1                       | 3153 683    | Ci,-      | 00 Nd?                  |
| 3146 871    |           | 0                       | 3153 866 s  | Fe?       | 1                       |
| 3147 049    |           | 1                       | 3153 985    |           | 0000                    |
| 3147 183    | Co        | 2                       | 3154 120    |           | 00                      |
| 3147 350    | Cr        | 3                       | 3154 235    |           | 00                      |
| 3147 382    | Ti?, Fe?  | 2                       | 3154 315    | Fe, Ti    | 3                       |
| 3147 562    |           | 1                       | 3154 535    |           | 1                       |
| 3147 714    | Fe?       | 1                       | 3154 608    | -,Fe      | 1                       |
| 3147 899    | -,Fe?     | 1                       | 3154 710    |           | 0                       |
| 3148 157    | Li        | 2                       | 3154 758    | -,Co      | 0                       |
| 3148 283    | Mn        | 1                       | 3154 903    | -,Co      | 1                       |
| 3148 422    |           | 00                      | 3155 055    |           | 000 N                   |
| 3148 555    | Fe, Cr    | 3                       | 3155 245    | -,Cr      | 1                       |
| 3148 757    |           | 0000 N                  | 3155 405    | Fe        | 1                       |
| 3148 912    |           | 0 N                     | 3155 520    |           | 00                      |
| 3149 015    |           | 0                       | 3155 737    |           | 0                       |
| 3149 237    |           | 000 N                   | 3155 773    | Ti        | 3                       |
| 3149 432    | Co        | 1                       | 3155 910    | V         | 0                       |
| 3149 512    |           | 000                     | 3156 020    |           | 0                       |
| 3149 612    |           | 00                      | 3156 055    |           | 0                       |
| 3149 757    |           | 0000                    | 3156 205    |           | 0000                    |
| 3149 839    |           | 0                       | 3156 305    |           | 0000                    |
| 3149 967    |           | 2                       | 3156 387    | Fe        | 2                       |
| 3150 013    |           | 1                       | 3156 565    | Fe?       | 1                       |
| 3150 192    |           | 1                       | 3156 680    |           | 0                       |
| 3150 344    |           | 0                       | 3156 842    |           | 00                      |
| 3150 422    | Fe        | 1                       | 3156 960    |           | 0                       |
| 3150 532    |           | 00                      | 3157 030    |           | 0                       |
| 3150 627    |           | 000                     | 3157 145    | Fe        | 2                       |
| 3150 767    | Co?       | 0000                    | 3157 257    | Co, Fe?   | 1                       |
| 3150 862    |           | 1                       | 3157 408    |           | 0                       |



| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3157 525    | Ti?       | 1                       | 3163 336    |           | 0                       |
| 3157 615    |           | 1 N                     | 3163 536    |           | 2                       |
| 3157 748    |           | 00                      | 3163 671    |           | 0000                    |
| 3157 865    |           | 0                       | 3163 796    | Cr        | 0000                    |
| 3157 996    | Fe        | 1                       | 3163 881    |           | 0                       |
| 3158 110    | Fe?       | 0                       | 3164 001    | Fe        | 1                       |
| 3158 163    |           | 0                       | 3164 043    |           | 1                       |
| 3158 305    |           | 00                      | 3164 161    |           | 0                       |
| 3158 465    |           | 0                       | 3164 286    | Cr        | 00                      |
| 3158 517    |           | 1                       | 3164 408    | Fe?       | 1                       |
| 3158 635    |           | 0                       | 3164 531    |           | 0                       |
| 3158 747    |           | 0                       | 3164 661    |           | 0                       |
| 3158 897    | Co        | 1                       | 3164 798    |           | 1                       |
| 3159 000    | Ca        | 2                       | 3164 946    |           | 1                       |
| 3159 125    | Fe?       | 0                       | 3165 011    |           | 000                     |
| 3159 225    |           | 0                       | 3165 117    | Fe        | 1                       |
| 3159 375    |           | 0                       | 3165 196    |           | 000                     |
| 3159 463    |           | 0                       | 3165 269    |           | 1                       |
| 3159 550    |           | 00                      | 3165 378    |           | 0                       |
| 3159 645    |           | 1                       | 3165 532    | Zr        | 00                      |
| 3159 785    | Co        | 0                       | 3165 624    |           | 1                       |
| 3159 945    |           | 00 N                    | 3165 787    |           | 000 N                   |
| 3160 049    |           | 0 N                     | 3165 987    | Fe        | 1                       |
| 3160 196    |           | 00                      | 3166 070    | ,Zi       | 2                       |
| 3160 327    | Fe?       | 2                       | 3166 242    |           | 0                       |
| 3160 461    | Fe        | 1                       | 3166 367    | 11        | 1                       |
| 3160 586    |           | 0000                    | 3166 447    |           | 0                       |
| 3160 726    | Cr?       | 00                      | 3166 550    | Fe        | 1                       |
| 3160 761    | Fe        | 2                       | 3166 707    |           | 0                       |
| 3160 915    |           | 1                       | 3166 786    |           | 1                       |
| 3161 036    |           | 0                       | 3166 879    |           | 0                       |
| 3161 146    | Mn        | 0                       | 3166 977    |           | 000                     |
| 3161 317    | Ti        | 3                       | 3167 097    |           | 00                      |
| 3161 495    | Fe        | 1                       | 3167 289 s  | Mn        | 1                       |
| 3161 536    |           | 0                       | 3167 407    |           | 0000                    |
| 3161 666    |           | 00                      | 3167 527    |           | 000 N                   |
| 3161 766    | Co        | 000                     | 3167 707    |           | 00 N                    |
| 3161 887    | 11        | 3                       | 3167 902    |           | 1                       |
| 3162 014    |           | 0                       | 3167 971    |           | 3                       |
| 3162 065    | Fe        | 3                       | 3168 022    | Fe?       | 2                       |
| 3162 236    |           | 0000                    | 3168 157    |           | 0000                    |
| 3162 291    |           | 0000                    | 3168 263    |           | 2                       |
| 3162 466    | Fe?       | 1                       | 3168 392    |           | 0000                    |
| 3162 546    |           | 00                      | 3168 547    |           | 000                     |
| 3162 683    | Ti        | 4                       | 3168 640    | Ti        | 4                       |
| 3162 816    |           | 000                     | 3168 784    |           | 0                       |
| 3162 916    |           | 0                       | 3168 968    | Fe        | 1                       |
| 3163 036    |           | 0000                    | 3169 067    | Fe?       | 1                       |
| 3163 141    |           | 0000                    | 3169 187    | Co?       | 000                     |
| 3163 208    |           | 1                       | 3169 304    | Co?,      | 0                       |

| Wave length  | Substance | Intensity and Character | Wave length | Substance       | Intensity and Character |
|--------------|-----------|-------------------------|-------------|-----------------|-------------------------|
| 3169 478     | Co        | 1                       | 3175 931    | La?, Fe?        | 0000                    |
| 3169 539     |           | 1                       | 3176 099 s  |                 | 1                       |
| 3169 727     |           | 0                       | 3176 211    |                 | 0000                    |
| 3169 864     |           | 1                       | 3176 410    |                 | 1 } d                   |
| 3169 972     |           | 0                       | 3176 462    | Fe?             | 1 }                     |
| 3170 117     |           | 0000                    | 3176 556    |                 | 00                      |
| 3170 239     |           | 00                      | 3176 711    |                 | 0000                    |
| 3170 367     |           | 0000                    | 3176 786    |                 | 0000                    |
| 3170 455     | Fe, Mo    | 2                       | 3176 946    | Fe?             | 000                     |
| 3170 592     |           | 00                      | 3177 041    |                 | 0000                    |
| 3170 822     |           | 1                       | 3177 191    |                 | 00                      |
| 3170 917     |           | 0000                    | 3177 413    | Co              | 2                       |
| 3171 096     | Fe        | 0                       | 3177 633    | Fe?             | 2                       |
| 3171 252     |           | 000                     | 3177 791    | Fe              | 1                       |
| 3171 327     |           | 0000                    | 3177 933    |                 | 00Nd?                   |
| 3171 466     |           | 2                       | 3178 132    |                 | 2                       |
| 3171 577     | Fe?       | 0000                    | 3178 272    |                 | 1                       |
| 3171 776     |           | 1                       | 3178 437    | Mn, Fe?         | 0000                    |
| 3171 882     |           | 00                      | 3178 542    |                 | 00                      |
| 3172 047     |           | 000                     | 3178 620    |                 | 1 Nd?                   |
| 3172 162 } s | Fe?       | 3                       | 3178 752    |                 | 0000                    |
| 3172 198 }   |           | 4                       | 3178 897    | Fe?             | 0000 d                  |
| 3172 408     |           | 0                       | 3179 077    | Fe              | 0                       |
| 3172 488     |           | 0000                    | 3179 172    | Cr?,<br>Cr?, Ca | 00                      |
| 3172 618     | Li?       | 0                       | 3179 277    |                 | 000 N                   |
| 3172 758     |           | 000                     | 3179 453    |                 | 5 d?                    |
| 3172 833     |           | 0000                    | 3179 624    |                 | 1 N                     |
| 3172 963     | Fe?       | 000                     | 3179 782    | Fe, Co          | 000 N                   |
| 3173 108     |           | 1                       | 3180 012    |                 | 0                       |
| 3173 321     |           | 0                       | 3180 077    |                 | 00                      |
| 3173 519     |           | 1                       | 3180 232    |                 | 00 N                    |
| 3173 661     | Fe?       | 00                      | 3180 347    | Ca              | 3                       |
| 3173 716     |           | 1                       | 3180 602    |                 | 0                       |
| 3173 794     |           | 1                       | 3180 821    |                 | 2                       |
| 3173 951     |           | 000                     | 3180 857    |                 | 2                       |
| 3174 061     | Co?       | 000                     | 3180 992    | Fe              | 000                     |
| 3174 166     |           | 00                      | 3181 162    |                 | 000                     |
| 3174 266     |           | 0                       | 3181 242    |                 | 0000                    |
| 3174 332     |           | 0                       | 3181 312    |                 | 0000                    |
| 3174 491     | Co        | 0                       | 3181 387    | ,Ca<br>,Cr?     | 3                       |
| 3174 601     |           | 1                       | 3181 531    |                 | 0                       |
| 3174 808     |           | 2                       | 3181 642    |                 | 1                       |
| 3174 896     |           | 0000                    | 3181 752    | Fe              | 00                      |
| 3175 064     | Cd?, Fe   | 1                       | 3181 856    | Ni              | 0                       |
| 3175 156     |           | 0                       | 3181 975    |                 | 1                       |
| 3175 276     |           | 0000                    | 3182 022    |                 | 1                       |
| 3175 425     |           | 1                       | 3182 172    |                 | 1                       |
| 3175 562     | Fe?       | 2                       | 3182 232    | -Fe<br>Co       | 00                      |
| 3175 666     |           | 0000                    | 3182 357    |                 | 0                       |
| 3175 821     |           | 0000                    | 3182 427    |                 | 0                       |

| Wave length  | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|--------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3182 582     |           | 2                       | 3188 656    | ,Fe       | 6d?                     |
| 3182 762     |           | 0 N                     | 3188 934    | Fe        | 2                       |
| 3182 918     | Zr        | 0                       | 3189 046    |           | 000                     |
| 3182 961     |           | 1                       | 3189 196    |           | 0000                    |
| 3183 101     | Fe, Ni?   | 3                       | 3189 281    |           | 0000                    |
| 3183 235     | Fe?       | 2                       | 3189 429    |           | 0                       |
| 3183 372     | Ni?       | 0                       | 3189 606    |           | 00 N                    |
| 3183 428     | Cr?       | 00                      | 3189 746    |           | 0000                    |
| 3183 533     | V         | 1                       | 3189 876    |           | 00                      |
| 3183 631     |           | 000                     | 3189 936    | Co        | 000                     |
| 3183 692     |           | 0                       | 3190 076    |           | 000                     |
| 3183 873     |           | 0000 N                  | 3190 154    | Fe?       | 1 } d                   |
| 3184 075     |           | 2                       | 3190 216    |           | 1 }                     |
| 3184 109     | V         | 2                       | 3190 276    |           | 000                     |
| 3184 225     | Ti        | 1                       | 3190 406    |           | 000                     |
| 3184 321     |           | 0                       | 3190 516    |           | 000                     |
| 3184 490     | ,Ni       | 2                       | 3190 651    |           | 000                     |
| 3184 553     |           | 000                     | 3190 795    | V         | 2                       |
| 3184 658     |           | 00                      | 3190 961    | Fe?       | 2                       |
| 3184 726     | -,Fe?     | 1                       | 3191 011    | Ti        | 3                       |
| 3184 873     |           | 0000                    | 3191 236    | Fe?       | 0                       |
| 3185 006     | Fe        | 2                       | 3191 306    |           | 00                      |
| 3185 133     |           | 1 N                     | 3191 426    | Co        | 000                     |
| 3185 203     |           | 0000                    | 3191 526    |           | 0                       |
| 3185 333     |           | 0000 N                  | 3191 676    |           | 0000                    |
| 3185 438     |           | 2                       | 3191 776    | Fe        | 2                       |
| 3185 499     | V         | 2                       | 3191 911    |           | 00                      |
| 3185 675     |           | 00                      | 3192 001    |           | 00                      |
| 3185 785     |           | 0                       | 3192 120    | Ii        | 2                       |
| 3185 915     |           | 000 N                   | 3192 151    |           | 00                      |
| 3186 090     | Co,-      | 0                       | 3192 306    |           | 00                      |
| 3186 215     |           | 0 Nd?                   | 3192 386    | Co?       | 0                       |
| 3186 383     |           | 00                      | 3192 508    | Fe?       | 0                       |
| 3186 494     | Co        | 0                       | 3192 646    |           | 00                      |
| 3186 564     | Ti        | 1                       | 3192 729    |           | 00                      |
| 3186 745     |           | 0000                    | 3192 836    |           | 000                     |
| 3186 863     | Fe        | 3                       | 3192 936    | Fe        | 2                       |
| 3186 905     |           | 1                       | 3193 029    | Fe?       | 1 N                     |
| 3187 075     |           | 00                      | 3193 166    |           | 00                      |
| 3187 175     |           | 0000                    | 3193 346    | Co, Fe    | 3                       |
| 3187 279     |           | 0                       | 3193 413    | Fe        | 2                       |
| 3187 419     |           | 1                       | 3193 661    |           | 000 N                   |
| 3187 667     |           | 0 Nd?                   | 3193 846    |           | 00 N                    |
| 3187 824     | V         | 2                       | 3193 928    | Fe?       | 1 N                     |
| 3188 010     |           | 0000                    | 3194 091    | Mo        | 000                     |
| 3188 145 } s | Cr?       | 1                       | 3194 206    | Cu        | 0                       |
| 3188 170 }   | Fe?       | 1                       | 3194 346    |           | 00                      |
| 3188 310     |           | 0000                    | 3194 451    |           | 0000                    |
| 3188 446     |           | 0                       | 3194 543    | Fe        | 1                       |
| 3188 487     | Co        | 0                       | 3194 636    |           | 00                      |

| Wave length | Substance            | Intensity and Character | Wave length | Substance           | Intensity and Character |
|-------------|----------------------|-------------------------|-------------|---------------------|-------------------------|
| 3194 698    |                      | I                       | 3201 494    |                     | 000                     |
| 3194 876    |                      | 000                     | 3201 624    |                     | 00                      |
| 3194 961    |                      | 0                       | 3201 724    | Γ <sub>1</sub>      | 00                      |
| 3195 085    |                      | 00                      | 3201 834    |                     | 000 N                   |
| 3195 197    |                      | 0                       | 3202 004    |                     | 000                     |
| 3195 252    |                      | 00                      | 3202 069    |                     | 000                     |
| 3195 342    |                      | 00                      | 3202 253    | N <sub>1</sub>      | I                       |
| 3195 517    |                      | 000 N                   | 3202 369    |                     | 00                      |
| 3195 705 s  | N <sub>1</sub>       | 2                       | 3202 494    | V                   | 0                       |
| 3195 837    | Γ <sub>1</sub> ?     | I                       | 3202 651    | Γ <sub>1</sub> , Fe | 2                       |
| 3195 987    |                      | 0000                    | 3202 779    |                     | 0                       |
| 3196 102    |                      | 0                       | 3202 807    |                     | 0                       |
| 3196 218    | Fe?                  | 3                       | 3202 934    |                     | 0                       |
| 3196 307    | Fe?                  | 00                      | 3203 054    |                     | 0                       |
| 3196 452    |                      | 000                     | 3203 144    | Co                  | 000                     |
| 3196 577    |                      | 000                     | 3203 274    |                     | 0000 N                  |
| 3196 682    |                      | 00                      | 3203 435    |                     | I                       |
| 3196 737    |                      | 00                      | 3203 552    | I <sub>1</sub> ,    | 2                       |
| 3196 947    |                      | 0000                    | 3203 624    |                     | 000                     |
| 3197 037    | Fe                   | I                       | 3203 724    |                     | 0000                    |
| 3197 085    | Fe                   | 2                       | 3203 824    |                     | 0000                    |
| 3197 222    | Cr, N <sub>1</sub>   | 3                       | 3203 944    | I <sub>1</sub>      | I                       |
| 3197 318    |                      | 000                     | 3204 092    |                     | I                       |
| 3197 473    |                      | 0000                    | 3204 225    |                     | 0000                    |
| 3197 653    | I <sub>1</sub> , Fe? | I                       | 3204 396    |                     | 2 Nd?                   |
| 3197 708    |                      | 00                      | 3204 565    |                     | 00                      |
| 3197 822    |                      | I N                     | 3204 685    |                     | 0000                    |
| 3197 983    |                      | 0000                    | 3204 805    |                     | 0000                    |
| 3198 133    | V                    | 0                       | 3204 975    | Γ <sub>1</sub> ?    | 0                       |
| 3198 213    | Li?                  | 000                     | 3205 065    |                     | 000                     |
| 3198 388    |                      | 0                       | 3205 225    |                     | 00                      |
| 3198 599    |                      | I                       | 3205 335    |                     | 0                       |
| 3198 799    | ,Co                  | 00 Nd                   | 3205 445    |                     | 00                      |
| 3199 014    | Fe?                  | 000 N                   | 3205 520    | Fe                  | 2                       |
| 3199 249    |                      | 0                       | 3205 685    | V                   | 00                      |
| 3199 349    |                      | 0000                    | 3205 765    |                     | 000                     |
| 3199 454    | ,Co?                 | 0                       | 3205 895    |                     | 00                      |
| 3199 639    | Fe                   | 4                       | 3205 950    | Γ <sub>1</sub> ?    | 000                     |
| 3199 774    |                      | 00                      | 3206 119    |                     | I                       |
| 3199 934    |                      | 0000 N                  | 3206 225    |                     | 0000                    |
| 3200 034 s  | T <sub>1</sub>       | 2                       | 3206 350    |                     | 0                       |
| 3200 249    |                      | 00                      | 3206 460    | Γ <sub>1</sub> ?    | 000                     |
| 3200 407    |                      | 2 Nd?                   | 3206 605    |                     | 00                      |
| 3200 581    | N <sub>1</sub> , Fe  | 5 Nd?                   | 3206 645    |                     | 00                      |
| 3200 734    |                      | 000                     | 3206 875    | -, I <sub>1</sub> ? | 0 Nd?                   |
| 3200 903    | Fe?                  | 2                       | 3207 055    | Mn?, -              | I                       |
| 3201 074    |                      | I                       | 3207 193    | -, Fe?              | I                       |
| 3201 126    |                      | I                       | 3207 290    |                     | 00                      |
| 3201 239    | Fe?                  | 0000                    | 3207 360    |                     | 00                      |
| 3201 374    |                      | 00                      | 3207 525    | V                   | 0                       |

| Wave length | Substance         | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-------------------|-------------------------|-------------|-----------|-------------------------|
| 3207 675    |                   | 00                      | 3213 677    |           | 000                     |
| 3207 788    |                   | 1                       | 3213 807    |           | 00                      |
| 3207 823    |                   | 0                       | 3213 857    |           | 0                       |
| 3208 005    | Ti <sup>2</sup>   | 000                     | 3214 042    |           | 000                     |
| 3208 101    |                   | 0                       | 3214 143    | Fe        | 2                       |
| 3208 206    |                   | 0                       | 3214 185    | Fe, Ni    | 2                       |
| 3208 326    | Cu                | 0000                    | 3214 335    | ,Ti       | 1 N                     |
| 3208 464    | V                 | 1                       | 3214 515    | Fe        | 2                       |
| 3208 586    | Fe                | 1                       | 3214 607    |           | 000                     |
| 3208 707    | Cr <sup>2</sup> , | 1                       | 3214 727    |           | 00                      |
| 3208 801    |                   | 0                       | 3214 889    | Ti,       | 3                       |
| 3208 906    |                   | 000                     | 3214 977    |           | 000                     |
| 3209 006    |                   | 00                      | 3215 142    |           | 000 N                   |
| 3209 116    | Ti <sup>2</sup>   | 0000                    | 3215 292    |           | 1                       |
| 3209 229    |                   | 00                      | 3215 317    |           | 1                       |
| 3209 297    | Cr,               | 1                       | 3215 467    | Co?       | 0                       |
| 3209 411    | Fe                | 1                       | 3215 517    |           | 1                       |
| 3209 546    |                   | 00                      | 3215 707    |           | 000                     |
| 3209 601    |                   | 000                     | 3215 757    |           | 000                     |
| 3209 736    |                   | 000                     | 3215 827    |           | 0000                    |
| 3209 786    |                   | 000                     | 3215 957    |           | 1                       |
| 3209 876    |                   | 0000                    | 3216 061    | Fe        | 2                       |
| 3210 046    | ,Ni               | 1 N                     | 3216 162    |           | 000                     |
| 3210 158    |                   | 0                       | 3216 327    |           | 0                       |
| 3210 337    | Fe, Co            | 3                       | 3216 472    |           | 000 N                   |
| 3210 564    |                   | 2                       | 3216 659    |           | 0                       |
| 3210 592    | Fe?               | 1                       | 3216 807    |           | 1                       |
| 3210 751    |                   | 0                       | 3216 928    | ,Ni       | 0                       |
| 3210 836    |                   | 00                      | 3217 040    | Mn, li?   | 1 N                     |
| 3210 948    | Fe                | 2                       | 3217 183    | li        | 2                       |
| 3211 056    | Co <sup>2</sup> , | 000                     | 3217 210    |           | 1                       |
| 3211 176    |                   | 000                     | 3217 413    |           | 000                     |
| 3211 281    |                   | 00                      | 3217 505    | Fe, Cr    | 2                       |
| 3211 321    |                   | 00                      | 3217 658    |           | 0000 N                  |
| 3211 421    | Cr?               | 000                     | 3217 838    |           | 0000                    |
| 3211 602    | Fe?               | 1                       | 3217 954    | Ni        | 1                       |
| 3211 746    |                   | 1                       | 3218 048    | li        | 000                     |
| 3211 796    | Fe?               | 1                       | 3218 188    |           | 00                      |
| 3211 996    | Fe?               | 1                       | 3218 318    |           | 0000                    |
| 3212 117    | Fe                | 2                       | 3218 389 s  | Ti        | 2                       |
| 3212 277    |                   | 1                       | 3218 563    |           | 000                     |
| 3212 435    |                   | 0                       | 3218 728    |           | 00                      |
| 3212 552    |                   | 00                      | 3218 798    | Cr?       | 00                      |
| 3212 657    |                   | 1                       | 3218 978    |           | 0000                    |
| 3212 802    |                   | 00                      | 3219 098    | Co?       | 000                     |
| 3213 004    | Mn,               | 2 N                     | 3219 260    |           | 1                       |
| 3213 247    | Ti                | 1                       | 3219 313    | Co, Ti    | 00                      |
| 3213 423    | Fe                | 3                       | 3219 483    |           | 000 N                   |
| 3213 517    |                   | 00                      | 3219 543    |           | 0000                    |
| 3213 587    |                   | 00                      | 3219 711 s  | Fe, Cl    | 2                       |

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3219 919 s  | Fe        | 3                       | 3226 266    | Ti        | 0                       |
| 3220 079    |           | 0000 N                  | 3226 342    |           | 0000                    |
| 3220 259    |           | 0000Nd?                 | 3226 462    |           | 0000                    |
| 3220 426    |           | 0                       | 3226 562    |           | 00                      |
| 3220 547    |           | 0                       | 3226 657    | Cr?       | 00                      |
| 3220 664    |           | 00                      | 3226 854    | Fe?       | 1 } d                   |
| 3220 721    |           | 00                      | 3226 880    | -, li     | 2 }                     |
| 3220 889    |           | 000                     | 3227 007    |           | 00                      |
| 3220 949    |           | 000                     | 3227 123    | Ni        | 1                       |
| 3221 084    |           | 0000 N                  | 3227 175    | Fe?       | 1                       |
| 3221 249    |           | 000                     | 3227 292    |           | 0000                    |
| 3221 388    | Ni        | 1                       | 3227 392    | Cl?       | 0000                    |
| 3221 499    | li        | 00                      | 3227 542    |           | 0000                    |
| 3221 659    |           | 000                     | 3227 612    |           | 0000                    |
| 3221 773    | , Ni      | 2                       | 3227 747    |           | 0000                    |
| 3221 874    |           | 0000                    | 3227 877    | Fe        | 2 } d                   |
| 3222 002    |           | 0                       | 3227 925    | Fe        | 2 }                     |
| 3222 034    | Fe?       | 1                       | 3228 112    |           | 0                       |
| 3222 201 s  | Fe        | 3                       | 3228 219    | Mn        | 1                       |
| 3222 374    |           | 000 N                   | 3228 370    | Fe        | 1                       |
| 3222 559    |           | 000 N                   | 3228 503    |           | 000                     |
| 3222 699    |           | 000 N                   | 3228 618    |           | 00                      |
| 3222 844    | Ti?       | 000 N                   | 3228 735    | Ti?       | 2                       |
| 3222 970    | li,       | 4                       | 3228 953    |           | 0                       |
| 3223 059    |           | 000                     | 3229 016    | Fe?       | 0                       |
| 3223 214    |           | 000                     | 3229 263    | Fe        | 2 } d                   |
| 3223 378    |           | 1                       | 3229 324    | li, Cr    | 3 }                     |
| 3223 479    |           | 00                      | 3229 468    |           | 0000                    |
| 3223 564    |           | 00                      | 3229 542    | Ti        | 2                       |
| 3223 631    | li        | 0                       | 3229 704    |           | 1                       |
| 3223 754    |           | 000                     | 3229 911    | Fe?       | 0                       |
| 3223 859    |           | 000                     | 3229 999    | li        | 0                       |
| 3223 962    |           | 0                       | 3230 106    | , Fe      | 1                       |
| 3224 154    |           | 0000 N                  | 3230 213    |           | 0                       |
| 3224 368 s  | Ti,-      | 2                       | 3230 323    | Fe        | 1                       |
| 3224 540    |           | 0000                    | 3230 588    |           | 0 N                     |
| 3224 600    |           | 0000 N                  | 3230 708    |           | 00                      |
| 3224 750    | Co        | 00                      | 3230 843    | Mn,       | 1                       |
| 3224 882    | Mn        | 1                       | 3230 962    |           | 00                      |
| 3225 040    |           | 0                       | 3231 123    | Fe,       | 2                       |
| 3225 146    | Ni        | 1                       | 3231 193    |           | 0000                    |
| 3225 237    |           | 0000                    | 3231 338    |           | 0000                    |
| 3225 382    |           | 00                      | 3231 442 s  | li        | 2                       |
| 3225 487    |           | 000                     | 3231 588    |           | 00                      |
| 3225 577    |           | 00 N                    | 3231 703    |           | 0                       |
| 3225 732    | Fe?       | 0                       | 3231 823    | Zr        | 1                       |
| 3225 827    |           | 000                     | 3231 958    |           | 0000                    |
| 3225 919 s  | Fe        | 3                       | 3232 063    |           | 00                      |
| 3226 024    |           | 0                       | 3232 193    |           | 0000                    |
| 3226 143    | Mn        | 0                       | 3232 273    |           | 00                      |

| Wave length | Substance          | Intensity and Character | Wave length | Substance            | Intensity and Character |
|-------------|--------------------|-------------------------|-------------|----------------------|-------------------------|
| 3232 407 s  | I <sub>1</sub>     | 2                       | 3239 170    | I <sub>1</sub>       | 7                       |
| 3232 509    |                    | 0000                    | 3239 435    |                      | 0                       |
| 3232 664    |                    | 0000 N                  | 3239 574    | Fe                   | 3                       |
| 3232 804    |                    | 000 N                   | 3239 786    | I <sub>1</sub>       | 2                       |
| 3232 914    | T <sub>1</sub>     | 00                      | 3239 966    |                      | 000                     |
| 3233 055    | N <sub>1</sub>     | 2                       | 3240 137    |                      | 0                       |
| 3233 171    | Fe                 | 1                       | 3240 239    |                      | 00                      |
| 3233 284    | N <sub>1</sub> ?   | 00                      | 3240 381    |                      | 0000 N                  |
| 3233 394    | Cr?                | 00 N                    | 3240 522    | Mn                   | 1                       |
| 3233 554    |                    | 0000 N                  | 3240 616    |                      | 0000                    |
| 3233 654    |                    | 000                     | 3240 726    | Mn                   | 0                       |
| 3233 786    |                    | 00                      | 3240 826    |                      | 1                       |
| 3233 879    |                    | 00                      | 3240 991    |                      | 0000                    |
| 3234 093    | Fe                 | 2                       | 3241 081    | C <sub>1</sub>       | 000                     |
| 3234 189    | Zr,                | 0 N                     | 3241 168    | Z <sub>1</sub>       | 1                       |
| 3234 394    |                    | 000 N                   | 3241 256    |                      | 0000                    |
| 3234 469    |                    | 000 N                   | 3241 366    |                      | 0000                    |
| 3234 635    | T <sub>1</sub>     | 3                       | 3241 509    |                      | 0                       |
| 3234 764    | Fe, N <sub>1</sub> | 3                       | 3241 607    |                      | 0                       |
| 3234 894    |                    | 0000 N                  | 3241 721    |                      | 0000                    |
| 3235 049    |                    | 0                       | 3241 806    |                      | 00                      |
| 3235 144    |                    | 00                      | 3241 936    |                      | 000 N                   |
| 3235 304    |                    | 00                      | 3242 125    | I <sub>1</sub> ,     | 8                       |
| 3235 444    |                    | 0                       | 3242 226    |                      | 0000 N                  |
| 3235 674    | Co                 | 0                       | 3242 395    |                      | 1                       |
| 3235 701    | Fe?                | 0                       | 3242 531    |                      | 0000                    |
| 3235 888    | Zr                 | 1                       | 3242 607    |                      | 0000                    |
| 3235 913    |                    | 0                       | 3242 747    |                      | 00                      |
| 3236 050    |                    | 0000                    | 3242 827    |                      | 00                      |
| 3236 251    | T <sub>1</sub>     | 1                       | 3242 952    |                      | 000                     |
| 3236 349    | Fe                 | 2                       | 3243 132    |                      | 1                       |
| 3236 540    |                    | 00 N                    | 3243 189    | ,N <sub>1</sub>      | 6                       |
| 3236 703 s  | T <sub>1</sub>     | 7 N                     | 3243 332    | Cu?                  | 000                     |
| 3236 905    | Mn,                | 1                       | 3243 532    |                      | 1                       |
| 3237 040    |                    | 000                     | 3243 682    | I <sub>1</sub> ?, Co | 000 N                   |
| 3237 154    | Co                 | 1                       | 3243 883    | ,Mn                  | 2                       |
| 3237 260    |                    | 000                     | 3243 978    | Co                   | 1                       |
| 3237 350    |                    | 0                       | 3244 147    |                      | 0000 N                  |
| 3237 548    |                    | 1 N                     | 3244 257    |                      | 0                       |
| 3237 700    |                    | 000                     | 3244 317    | C <sub>1</sub>       | 0                       |
| 3237 840    | Cr                 | 00                      | 3244 472    | Fe                   | 3                       |
| 3237 967    | V                  | 2 Nd?                   | 3244 617    |                      | 0 N                     |
| 3238 155    |                    | 0                       | 3244 667    |                      | 00                      |
| 3238 205    | Cr                 | 0                       | 3244 822    |                      | 00                      |
| 3238 330    | T <sub>1</sub>     | 000                     | 3244 987    |                      | 00 N                    |
| 3238 435    |                    | 00                      | 3245 137    |                      | 00                      |
| 3238 635    | Cr?                | 00                      | 3245 257    |                      | 00 N                    |
| 3238 670    |                    | 00                      | 3245 397    |                      | 00 N                    |
| 3238 885    |                    | 0                       | 3245 517    |                      | 000 N                   |
| 3239 015    |                    | 00 N                    | 3245 662    | C <sub>1</sub>       | 1                       |
|             |                    |                         |             |                      | 0                       |

| Wave length  | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|--------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3245 847     |           | 0000                    | 3252 729    | Ca        | o N                     |
| 3245 907     |           | 0000                    | 3252 865    | Cr        | o N                     |
| 3246 104 } s |           | 4                       | 3253 012    | Fe, Fe    | 5                       |
| 3246 150 } s | Fe        | 3                       | 3253 090    | Mn        | 4                       |
| 3246 290     |           | 0000                    | 3253 158    |           | 000                     |
| 3246 429     |           | 000                     | 3253 274    |           | 000                     |
| 3246 613     | Fe        | 2                       | 3253 391    |           | oo Nd?                  |
| 3246 803     |           | 0000                    | 3253 531    |           | 000                     |
| 3246 889     |           | 0000                    | 3253 684    |           | 0                       |
| 3247 096     | Co        | 4                       | 3253 731    | Fe        | 2                       |
| 3247 311     | Co        | 3                       | 3253 841    |           | 0000                    |
| 3247 420     | Fe        | 1                       | 3253 964    | Fe        | 2 N                     |
| 3247 525     |           | 0                       | 3254 078    |           | 2                       |
| 3247 688 s   | Cu        | 10                      | 3254 180    | Mn        | 1 N                     |
| 3247 908     |           | 0000 N                  | 3254 314    | Ti        | 3                       |
| 3248 095     |           | 000 N                   | 3254 381    | Co        | 4                       |
| 3248 248     | Fe        | 1 N                     | 3254 497    | Fe        | 4                       |
| 3248 339     | Fe        | 3                       | 3254 590    |           | 2                       |
| 3248 442     |           | 0000                    | 3254 881    | V, Fe     | 5 d?                    |
| 3248 589     | Ni        | 2                       | 3255 150    |           | 000                     |
| 3248 637     | Mn        | o N                     | 3255 283    |           | 0000                    |
| 3248 731     |           | 1                       | 3255 413    |           | 000                     |
| 3248 841     | Ti        | 2                       | 3255 617    | Mn        | 1 N                     |
| 3248 987     |           | 0000 N                  | 3255 800    |           | 000 N                   |
| 3249 147     |           | 1                       | 3255 937    |           | 0000                    |
| 3249 313     | Fe        | 2 N                     | 3256 021    | Fe?       | 6                       |
| 3249 497     | Ti        | 2                       | 3256 102    |           | 0000                    |
| 3249 577     | Ni        | 2                       | 3256 264    | Mn        | 3                       |
| 3249 654     |           | 00                      | 3256 382    |           | 0000 N                  |
| 3249 754     |           | 00                      | 3256 616    |           | 1 N                     |
| 3249 803     |           | 0                       | 3256 830    | Fe        | 2                       |
| 3249 980     |           | 0                       | 3257 081    |           | 0000 N                  |
| 3250 046     |           | 000                     | 3257 223    |           | 2                       |
| 3250 136     | Co        | 1                       | 3257 355    | Fe        | 4                       |
| 3250 270     |           | 000 N                   | 3257 481    |           | 00                      |
| 3250 514     | Fe, Zr?   | 3 N                     | 3257 549    |           | 2                       |
| 3250 756     | Fe        | 3 N                     | 3257 721    | Fe        | 4                       |
| 3250 886     | Ni        | 4                       | 3257 944    | Cr        | 1                       |
| 3251 060     |           | 0000 N                  | 3258 028    |           | 0                       |
| 3251 273     | Mn        | o N                     | 3258 141    |           | 0                       |
| 3251 375     | Fe        | 3                       | 3258 221    | Co        | 0                       |
| 3251 472     |           | 1 N                     | 3258 408    |           | 0000                    |
| 3251 659     |           | 0000                    | 3258 542    | Mn, Co    | 3                       |
| 3251 732     |           | 000                     | 3258 752    |           | 1 N                     |
| 3251 805     |           | 0000                    | 3258 904    | Fe        | 3                       |
| 3251 977     | Fe        | 3                       | 3259 034    |           | 0000 N                  |
| 3252 057     |           | 4 d?                    | 3259 183    | Fe        | 3                       |
| 3252 245     |           | 00                      | 3259 357    |           | 0000 N                  |
| 3252 359     |           | 0000 N                  | 3259 494    |           | 0000 N                  |
| 3252 560     | Fe        | 4                       | 3259 567    |           | 0000 N                  |



# PRELIMINARY TABLE OF SOLAR SPECTRUM WAVE-LENGTHS XVI

By HENRY A ROWLAND

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3259 720    |           | 0                       | 3265 454    | Co        | 0 N                     |
| 3259 834    |           | 0                       | 3265 678    |           | 2                       |
| 3259 977    |           | 0000 N                  | 3265 762    | Fe        | 4                       |
| 3260 110    | Cr, Fe    | 4                       | 3265 822    |           | 00                      |
| 3260 266    |           | 000                     | 3266 016    | V         | 1                       |
| 3260 386 s  | Mn, Ti Fe | 5 d'                    | 3266 102    |           | 000                     |
| 3260 593    |           | 0000                    | 3266 275    |           | 000                     |
| 3260 673    |           | 00                      | 3266 362    |           | 000                     |
| 3260 813    |           | 000 N                   | 3266 561    |           | 00 Nt?                  |
| 3260 950    | Co        | 1                       | 3266 798    |           | 3 N                     |
| 3261 079    |           | 0000 N                  | 3267 072    |           | 1                       |
| 3261 186    |           | 00 N d?                 | 3267 184    |           | 1                       |
| 3261 319    |           | 0000 N                  | 3267 328    |           | 00                      |
| 3261 460    | Fe        | 2                       | 3267 391    |           | 000                     |
| 3261 705    | li        | 3                       | 3267 561    |           | 00                      |
| 3261 760    |           | 4                       | 3267 661    |           | 0000 N                  |
| 3261 938    |           | 00                      | 3267 834 s  | V         | 6                       |
| 3262 142    | Fe        | 2                       | 3267 910    | Mn        | 0000                    |
| 3262 409    | Fe Sn     | 3                       | 3268 186    | Fe        | 1                       |
| 3262 558    |           | 0000                    | 3268 366    |           | 3                       |
| 3262 838    |           | 0000 N                  | 3268 468    |           | 0000                    |
| 3263 023    |           | 3                       | 3268 558    |           | 0000                    |
| 3263 194    |           | 1                       | 3268 644    |           | 00                      |
| 3263 254    |           | 0000                    | 3268 847    | Mn        | 0000                    |
| 3263 355    | V, Co     | 0                       | 3268 983    |           | 000                     |
| 3263 491    | Fe        | 4                       | 3269 098    |           | 0                       |
| 3263 587    |           | 0000                    | 3269 207    |           | 000                     |
| 3263 813    | Ti        | 4                       | 3269 355    | Fe        | 1                       |
| 3263 960    |           | 0 N                     | 3269 462    | Fe        | 00                      |
| 3264 097    |           | 0                       | 3269 555    |           | 0                       |
| 3264 187    |           | 0                       | 3269 627    |           | 0                       |
| 3264 307    |           | 00 N                    | 3269 747    | Zi        | 0000 N                  |
| 3264 405    |           | 1                       | 3269 890    |           | 1                       |
| 3264 528    | Mo?       | 0                       | 3270 033    |           | 000                     |
| 3264 646    | Fe        | 4                       | 3270 089    | Fe        | 2                       |
| 3264 833    | Mn        | 2                       | 3270 265    | ,Co       | 1 N                     |
| 3264 906    | Co        | 2                       | 3270 473    | Mn        | 00                      |
| 3264 983    |           | 00                      | 3270 656    |           | 0000 N                  |
| 3265 176    | Fe,       | 3 d?                    | 3270 794    | Ti?       | 0                       |
| 3265 310    |           | 0000                    | 3270 872    |           | 0000 N                  |

| Wave length | Substance     | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|---------------|-------------------------|-------------|-----------|-------------------------|
| 3271 129    | Fe            | 6                       | 3278 221    |           | 000 N                   |
| 3271 266    | Ni, Co, Zr, V | 5                       | 3278 420    | Li        | 5                       |
| 3271 436    |               | 0000                    | 3278 574    |           | 0000                    |
| 3271 536    |               | 0000                    | 3278 687    | Mn        | 1                       |
| 3271 621    |               | 1                       | 3278 867    | Fe        | 3                       |
| 3271 791    | Ti, Fe        | 6d?                     | 3278 974    |           | 00                      |
| 3271 918    | Co            | 0                       | 3279 060    | Li        | 4                       |
| 3272 085    |               | 0000 N                  | 3279 279    |           | 1                       |
| 3272 217    | Li            | 5                       | 3279 400    | Zi, Co    | 2                       |
| 3272 367    | Zr            | 2                       | 3279 574    |           | 0000                    |
| 3272 558    |               | 0000 Nd?                | 3279 644    |           | 0000                    |
| 3272 729    |               | 1                       | 3279 784    |           | 0                       |
| 3272 855    |               | 0                       | 3279 872    | Fe        | 1                       |
| 3272 971    |               | 0000 N                  | 3279 973    | V         | 1                       |
| 3273 175    | Mn Zi         | 2                       | 3280 120    | Ti        | 2                       |
| 3273 311    |               | 0000                    | 3280 256    |           | 000 N                   |
| 3273 477    |               | 000                     | 3280 392    | Fe        | 4                       |
| 3273 606    |               | 1 N                     | 3280 493    |           | 0000 N                  |
| 3273 758    |               | 0                       | 3280 623    |           | 0000 N                  |
| 3273 844    |               | 0000                    | 3280 806    | Ag        | 0                       |
| 3273 970    |               | 0000 N                  | 3280 900    | Mn        | 1                       |
| 3274 096 s  | Cu            | 10                      | 3281 100    |           | 0000Nd?                 |
| 3274 350    |               | 1                       | 3281 250    |           | 0 N                     |
| 3274 575    | Fe            | 3                       | 3281 429    | Fe        | 5                       |
| 3274 677    |               | 0000                    | 3281 652    |           | 0000                    |
| 3274 800    |               | 0                       | 3281 725    |           | 0000                    |
| 3274 907    |               | 0000                    | 3281 841    |           | 2                       |
| 3275 033    |               | 1                       | 3281 993    | Ni        | 2 d'                    |
| 3275 149    |               | 0000                    | 3282 122    |           | 000                     |
| 3275 276    |               | 0000                    | 3282 372    |           | 00                      |
| 3275 353    |               | 0000                    | 3282 459    | Li, Zn    | 5                       |
| 3275 423    | Ti            | 3                       | 3282 572    |           | 0                       |
| 3275 529    |               | 0000                    | 3282 665    | V         | 1                       |
| 3275 603    |               | 0000                    | 3282 830    | Ni        | 2                       |
| 3275 716    |               | 000                     | 3282 962    | Ni        | 2                       |
| 3275 809    |               | 1                       | 3283 029    | Fe        | 2                       |
| 3275 969    |               | 0 N                     | 3283 179    |           | 000                     |
| 3276 103    |               | 000                     | 3283 286    |           | 00                      |
| 3276 250    | V             | 5 d'                    | 3283 332    |           | 00                      |
| 3276 386    |               | 00                      | 3283 458    | Co        | 0                       |
| 3276 594    | Co, Fe        | 3                       | 3283 576    | Co,-      | 2                       |
| 3276 741    |               | 1                       | 3283 680    | Fe        | 1                       |
| 3276 905    | Li            | 3                       | 3283 812    |           | 0000                    |
| 3277 124    | Li            | 2                       | 3283 929    |           | 00 N                    |
| 3277 225    |               | 0000                    | 3284 059    |           | 00                      |
| 3277 315    |               | 0                       | 3284 116    |           | 00                      |
| 3277 482    | Co-Fe :       | 7 d?                    | 3284 256    |           | 0000 N                  |
| 3277 795    | Co            | 0 N                     | 3284 366    |           | 0000                    |
| 3277 848    |               | 0 N                     | 3284 489    |           | 0000                    |
| 3277 997    |               | 0 N                     | 3284 559    | Ni        | 1                       |

| Wave length | Substance                         | Intensity and Character | Wave length | Substance       | Intensity and Character |
|-------------|-----------------------------------|-------------------------|-------------|-----------------|-------------------------|
| 3284 648    |                                   | 0                       | 3290 375    |                 | 00                      |
| 3284 723    | Fe                                | 2                       | 3290 475    |                 | 0000                    |
| 3284 847    | Zr                                | 1                       | 3290 602    |                 | 00                      |
| 3284 968    |                                   | 0 00                    | 3290 642    |                 | 0 N                     |
| 3285 148    |                                   | 0 N                     | 3290 765    |                 | 000                     |
| 3285 324    |                                   | 1                       | 3290 842    | Fe              | 2                       |
| 3285 421    |                                   | 0                       | 3291 119    | Fe              | 1                       |
| 3285 547    | Fe                                | 2                       | 3291 261    |                 | 0 N                     |
| 3285 678    |                                   | 00                      | 3291 411    |                 | 0900                    |
| 3285 828    |                                   | 0000                    | 3291 557    |                 | 00                      |
| 3285 908    |                                   | 0000                    | 3291 671    |                 | 000                     |
| 3286 034    | Fe <sup>2</sup> , Ti <sup>2</sup> | 000 N                   | 3291 824    | Fe              | 00                      |
| 3286 164    |                                   | 2                       | 3291 897    |                 | 1                       |
| 3286 197    |                                   | 0                       | 3292 151    | Fe              | 1                       |
| 3286 310    |                                   | 0000                    | 3292 206    | Fe, Co          | 3                       |
| 3286 384    |                                   | 000                     | 3292 337    |                 | 0000 N                  |
| 3286 494    |                                   | 0000                    | 3292 451    |                 | 0                       |
| 3286 580    |                                   | 1                       | 3292 636    |                 | 0                       |
| 3286 667    |                                   | 00                      | 3292 728    | Fe              | 4                       |
| 3286 784    |                                   | 0                       | 3292 870    |                 | 0000 N                  |
| 3286 898    | Fe                                | 7 N                     | 3292 996    | Mn <sup>2</sup> | 000                     |
| 3286 980    |                                   | 0 N                     | 3293 053    |                 | 00                      |
| 3287 086    | Ni                                | 3                       | 3293 276    | Fe, Co          | 2                       |
| 3287 224    | Fe                                | 2                       | 3293 350    |                 | 0000                    |
| 3287 347    | Co                                | 2                       | 3293 605    |                 | 00                      |
| 3287 460    | Zr <sup>2</sup>                   | 000                     | 3293 800    | Fe              | 1                       |
| 3287 560    |                                   | 000                     | 3293 900    |                 | 00                      |
| 3287 597    |                                   | 000                     | 3293 989    | Co <sup>2</sup> | 000 N                   |
| 3287 709    |                                   | 0000                    | 3294 125    |                 | 0000 N                  |
| 3287 793 s  | Ti                                | 5                       | 3294 235    |                 | 0000 N                  |
| 3287 863    |                                   | 0000                    | 3294 325    |                 | 000 N                   |
| 3287 986    |                                   | 0000 N                  | 3294 462    |                 | 0000 N                  |
| 3288 175    |                                   | 0                       | 3294 569    |                 | 0000 N                  |
| 3288 281    | Ti                                | 3                       | 3294 682    |                 | 0000                    |
| 3288 453    | Fe                                | 00 N                    | 3294 749    | Co              | 00                      |
| 3288 561    | Ti                                | 2                       | 3294 849    |                 | 000                     |
| 3288 705    | Ti                                | 2                       | 3294 949    |                 | 00 N                    |
| 3288 801    | Fe                                | 1                       | 3295 069    | Li              | 0                       |
| 3288 939    | Zr                                | 0                       | 3295 149    |                 | 0000                    |
| 3289 103    | Fe                                | 2                       | 3295 243    |                 | 0                       |
| 3289 153    |                                   | 0                       | 3295 375    |                 | 1                       |
| 3289 272    |                                   | 0000                    | 3295 562    |                 | 2                       |
| 3289 372    |                                   | 0000                    | 3295 732    |                 | 000                     |
| 3289 498    |                                   | 4                       | 3295 762    |                 | 0000                    |
| 3289 568    | V                                 | 3                       | 3295 951    | Fe, Mn          | 6                       |
| 3289 705    |                                   | 0000 N                  | 3296 168    | Mn <sup>2</sup> | 00                      |
| 3289 875    |                                   | 0000                    | 3296 388    |                 | 1 N                     |
| 3289 988    |                                   | 000                     | 3296 504    | Li <sup>2</sup> | 000 N                   |
| 3290 035    |                                   | 000                     | 3296 602    | Fe              | 2                       |
| 3290 238    |                                   | 0000 N                  | 3296 721    |                 | 0000 N                  |

| Wave length | Substance | Intensity and Character | Wave length  | Substance | Intensity and Character |
|-------------|-----------|-------------------------|--------------|-----------|-------------------------|
| 3296 948    |           | I                       | 3302 895     |           | 0000                    |
| 3297 014    | Mn        | I                       | 3302 990     |           | 3                       |
| 3297 194    |           | o N                     | 3303 109 s   | Na        | 5                       |
| 3297 301    | Co        | o                       | 3303 248     | I a       | 000 Nd?                 |
| 3297 381    |           | o                       | 3303 398     | Mn        | oo N                    |
| 3297 511    |           | 000                     | 3303 601 } s |           | 3                       |
| 3297 644    |           | 000                     | 3303 698 }   | Fe        | 2                       |
| 3297 720    |           | 000                     | 3303 908     |           | 000                     |
| 3297 793    |           | 000                     | 3304 022     |           | 0000 N                  |
| 3297 963    |           | o N                     | 3304 263     |           | 000                     |
| 3298 009    |           | I                       | 3304 375     | Mo?       | I                       |
| 3298 140    |           | 0000                    | 3304 492     |           | o                       |
| 3298 268    | Fe, V, Di | 5                       | 3304 577     |           | 000                     |
| 3298 361    | Mn        | 000                     | 3304 611     |           | 000                     |
| 3298 451    |           | 0000                    | 3304 719     |           | oo                      |
| 3298 545    |           | 0000                    | 3304 881     |           | oo N                    |
| 3298 685    |           | I                       | 3305 001     | Mn        | oo                      |
| 3298 818    | Co        | 2                       | 3305 089     | Ni        | I                       |
| 3298 869    | V         | 3                       | 3305 194     |           | 000                     |
| 3298 995    |           | 0000                    | 3305 283     | Co Zr     | 2                       |
| 3299 211    |           | I                       | 3305 354     |           | 000                     |
| 3299 305    |           | 0000                    | 3305 434     |           | 0000                    |
| 3299 477    |           | 0000                    | 3305 541     |           | 0000                    |
| 3299 564    | Ti        | 2                       | 3305 604     |           | 0000                    |
| 3299 652    | Mn        | o Nd?                   | 3305 754     |           | 000 N                   |
| 3299 804    |           | o                       | 3305 877     | Co        | o                       |
| 3299 905    |           | o                       | 3305 991     |           | 2                       |
| 3300 017    |           | 000                     | 3306 105 s   | Fe        | 4 N                     |
| 3300 204    |           | 0000 N                  | 3306 221     |           | 2 N                     |
| 3300 297    |           | oo N                    | 3306 296     |           | 0000                    |
| 3300 444    |           | 0000 Nd?                | 3306 412 } s | Zi        | 2                       |
| 3300 617    |           | 000                     | 3306 506 }   | Fe        | 4                       |
| 3300 687    |           | 0000 N                  | 3306 623     | Co        | I                       |
| 3300 802    |           | 000                     | 3306 726     |           | I                       |
| 3300 944    |           | 0000                    | 3306 830     |           | 000                     |
| 3301 039    |           | 000                     | 3306 903     |           | 0000                    |
| 3301 143    |           | 0000 N                  | 3307 010     | Ii        | oo                      |
| 3301 263    |           | 0000 N                  | 3307 114     | Mn        | I                       |
| 3301 352    | Fe        | I                       | 3307 165     | Fe        | 2                       |
| 3301 452    | Fe        | o                       | 3307 280     | Co        | I                       |
| 3301 706    |           | 0000                    | 3307 374     | Fe        | I                       |
| 3301 808    | Ti, Sr    | I                       | 3307 473     |           | 0000                    |
| 3301 909    |           | 0000                    | 3307 636     | Si?       | 000 N                   |
| 3301 996    |           | 0000                    | 3307 845     | Fe        | 4                       |
| 3302 055    | Fe        | o                       | 3308 035     |           | oo N                    |
| 3302 232    | Ii, Pd    | 4                       | 3308 239     |           | o N                     |
| 3302 289    |           | 0000 N                  | 3308 405     |           | 0000                    |
| 3302 443    |           | 0000 N                  | 3308 527     | Ii        | o                       |
| 3302 510 s  | Na        | 6                       | 3308 619     | Co        | oo                      |
| 3302 720    | Zn        | I                       | 3308 749     |           | 000                     |

\* A zinc line comes between these two



| Wave length           | Substance | Intensity and Character | Wave length           | Substance | Intensity and Character |
|-----------------------|-----------|-------------------------|-----------------------|-----------|-------------------------|
| 3320 391              | Ni        | 7                       | 3326 335              |           | 00                      |
| 3320 508              |           | 0000                    | 3326 432              |           | 000                     |
| 3320 621              |           | 0000                    | 3326 553              |           | 0                       |
| 3320 783              | Mn, Fe    | 2                       | 3326 727              |           | 0 N                     |
| 3320 907              | Fe, Ni    | 1                       | 3326 825              | Co        | 1                       |
| 3321 044              |           | 0000                    | 3326 907 <sup>†</sup> | Li        | 5                       |
| 3321 177              | Be?       | 0000 N                  | 3326 998 <sup>†</sup> |           | 3                       |
| 3321 324              |           | 000                     | 3327 127              | Co        | 1                       |
| 3321 366              |           | 0                       | 3327 297              |           | 00                      |
| 3321 494              |           | 0000                    | 3327 424              |           | 0000                    |
| 3321 550              | Be?       | 000                     | 3327 533              | Ni        | 2                       |
| 3321 667              |           | 00                      | 3327 633              | Fe        | 1                       |
| 3321 715              | Li        | 00                      | 3327 757              |           | 000                     |
| 3321 836              | Li,       | 4                       | 3327 861              |           | 0000 N                  |
| 3322 047              |           | 000 N                   | 3328 016              | Dir       | 2                       |
| 3322 190              |           | 0000                    | 3328 101              |           | 0                       |
| 3322 331              | Co        | 1 Nd <sup>†</sup>       | 3328 341              | Co        | 00                      |
| 3322 454              | Ni        | 3                       | 3328 487              |           | 2                       |
| 3322 610              | Fe        | 2                       | 3328 605              |           | 0                       |
| 3322 764              |           | 00                      | 3328 713              |           | 0000                    |
| 3322 833              |           | 00                      | 3328 840              | Ni        | 1                       |
| 3323 003              |           | 1                       | 3328 933              |           | 0000                    |
| 3323 050 <sup>†</sup> | Li        | 5                       | 3329 000              | Fe        | 3                       |
| 3323 116 <sup>†</sup> |           | 3                       | 3329 186              | Li, Fe    | 1                       |
| 3323 213              |           | 1                       | 3329 233              |           | 000                     |
| 3323 250              |           | 00                      | 3329 338              |           | 0000                    |
| 3323 426              |           | 0000                    | 3329 435              |           | 0000 N                  |
| 3323 524              |           | 1                       | 3329 568 <sup>†</sup> | Li, Co    | 5                       |
| 3323 660              |           | 0                       | 3329 648 <sup>†</sup> |           | 3                       |
| 3323 881              | Li        | 3                       | 3329 762              | Fe        | 0000 N                  |
| 3324 040              |           | 000                     | 3329 902              |           | 00                      |
| 3324 120              |           | 0                       | 3329 982              |           | 000                     |
| 3324 201              |           | 4 N                     | 3330 044              | Mg        | 3                       |
| 3324 280              |           | 0                       | 3330 102              |           | 2                       |
| 3324 491              | Fe        | 1                       | 3330 212              | Si?       | 000                     |
| 3324 674              | Fe        | 3                       | 3330 364              |           | 0                       |
| 3324 805              |           | 0                       | 3330 436              |           | 1                       |
| 3324 921              |           | 1                       | 3330 565              |           | 0000 N                  |
| 3325 142              |           | 0                       | 3330 645              |           | 000                     |
| 3325 168              |           | 0000                    | 3330 745              | Sn?       | 000                     |
| 3325 288              |           | 0000                    | 3330 802              | Mn        | 00                      |
| 3325 381              | Co        | 1                       | 3330 914              |           | 000                     |
| 3325 462              |           | 000                     | 3331 056              |           | 1 N                     |
| 3325 600              | Fe        | 3                       | 3331 194              |           | 000 N                   |
| 3325 712              |           | 000                     | 3331 384              |           | 00 N                    |
| 3325 820              |           | 0000                    | 3331 527              |           | 000                     |
| 3325 886              |           | 0000                    | 3331 747 <sup>†</sup> | Fe        | 2                       |
| 3326 028              |           | 000                     | 3331 915              | Fe        | 2                       |
| 3326 105              |           | 0000                    | 3332 061              |           | 000 N                   |
| 3326 212              |           | 0000                    | 3332 181              |           | 0                       |

<sup>†</sup> See note to 3335 192, 3335 350, etc

| Wave length           | Substance      | Intensity and Character | Wave length           | Substance       | Intensity and Character |       |
|-----------------------|----------------|-------------------------|-----------------------|-----------------|-------------------------|-------|
| 3332 240              | Mg             | 3                       | 3338 054 <sup>†</sup> |                 | 0                       |       |
| 3332 326              |                | 3                       | 3338 141              |                 | 0000                    |       |
| 3332 421              |                | 000 N                   | 3338 247              |                 | 0                       |       |
| 3332 481              |                | 00                      | 3338 368              |                 | 000                     |       |
| 3332 707              |                | 0000 N                  | 3338 478              |                 | 000                     |       |
| 3332 850              |                | 0000                    | 3338 561              |                 | 000                     |       |
| 3332 965              |                | 0                       | 3338 651              | Co              | 00                      |       |
| 3333 026              |                | 0000                    | 3338 750              | Fe              | 2                       |       |
| 3333 160              |                | 000                     | 3338 905              |                 | 0                       |       |
| 3333 250              |                | 0                       | 3338 944              |                 | 0000                    |       |
| 3333 353              | Co             | 000 N                   | 3339 051              |                 | 0000 N                  |       |
| 3333 526              |                | 2                       | 3339 180              | Ni <sup>2</sup> | 1                       |       |
| 3333 726              |                | 1                       | 3339 333              | Fe              | 2                       |       |
| 3333 854              |                | 0                       | 3339 438              |                 | 000 N                   |       |
| 3333 953              |                | 000                     | 3339 577              |                 | 000 N                   |       |
| 3334 046              |                | 000                     | 3339 713              | Fe              | 1                       |       |
| 3334 116              |                | 000                     | 3339 816              |                 | 1                       |       |
| 3334 266              |                | Co                      | 4                     | 3339 932        | Co, Cu                  | 3     |
| 3334 356              |                | Fe                      | 1                     | 3240 011        |                         | 1     |
| 3334 406              |                | Zn <sup>2</sup>         | 1                     | 3340 173        |                         | 000 N |
| 3334 613              | Zn             | 0                       | 3340 310              |                 | 0000 N                  |       |
| 3334 753              |                | 0                       | 3340 464 <sup>†</sup> | I <sub>1</sub>  | 3                       |       |
| 3334 846              |                | 0                       | 3340 523 <sup>†</sup> |                 | 2                       |       |
| 3334 933              |                | 0000 N                  | 3340 702              | Fe              | 2                       |       |
| 3335 065              |                | 000 N                   | 3340 823              |                 | 00 N                    |       |
| 3335 192              |                | 0000 N                  | 3340 957              |                 | 0000 N                  |       |
| 3335 299 <sup>†</sup> |                | I <sub>1</sub>          | 3341 027              |                 | 1                       |       |
| 3335 350 <sup>†</sup> |                | 2                       | 3341 137              |                 | 0000                    |       |
| 3335 439              |                | 1                       | 3341 300              |                 | 0000 N                  |       |
| 3335 553              |                | 1 N                     | 3341 417              |                 | 0000                    |       |
| 3335 666              | Fe             | 2 Nd <sup>2</sup>       | 3341 480              | Co              | 00                      |       |
| 3335 859              |                | 1                       | 3341 563              |                 | 0000                    |       |
| 3335 915              |                | 2                       | 3341 690              |                 | 0000                    |       |
| 3335 979              |                | 000                     | 3341 820              |                 | 000                     |       |
| 3336 054              |                | 0                       | 3341 967 <sup>†</sup> | I <sub>1</sub>  | 4                       |       |
| 3336 259              |                | 0                       | 3342 062 <sup>†</sup> | I <sub>1</sub>  | 4                       |       |
| 3336 391              |                | Fe                      | 2                     | 3342 280        |                         | 0     |
| 3336 477              |                | Cu                      | 2                     | 3342 358        | Fe, I <sub>1</sub>      | 3     |
| 3336 635              |                | Mg                      | 00 N                  | 3342 442        | I <sub>1</sub>          | 3     |
| 3336 679              |                |                         | 00                    | 3342 506        |                         | 0000  |
| 3336 820              | 8 N            |                         | 3342 606              |                 | 0000                    |       |
| 3336 962              | 0 N            |                         | 3342 717              | Cu              | 3                       |       |
| 3337 098              | 0              |                         | 3342 829              | I <sub>1</sub>  | 00                      |       |
| 3337 138              | 1              |                         | 3342 892              | Co              | 00                      |       |
| 3337 319              | 1 N            |                         | 3343 032              |                 | 00                      |       |
| 3337 471              | 0000           |                         | 3343 156              |                 | 00                      |       |
| 3337 524              | 000            |                         | 3343 361              |                 | 0                       |       |
| 3337 630              | I <sub>2</sub> |                         | 0                     | 3343 479        |                         | 00    |
| 3337 803              | Fe             | 3                       | 3343 656              |                 | 000 N                   |       |
| 3337 984 <sup>†</sup> | I <sub>1</sub> | 2                       | 3343 804              | Mn              | 1                       |       |

<sup>†</sup> There are several cases like this where there is a close double, one line at least belonging to I<sub>1</sub>. It is not certain in such cases that both are not I<sub>1</sub> lines. Possibly the second may be I<sub>1</sub> and not the first. The notes do not yet settle these cases, except 3314 573 and 3314 663, when both lines belong to I<sub>1</sub>.

| Wave length           | Substance          | Intensity and Character | Wave length | Substance                                     | Intensity and Character |
|-----------------------|--------------------|-------------------------|-------------|---|-------------------------|
| 3343 908              | I <sub>1</sub>     | 4                       | 3349 965    | D <sub>1</sub> <sup>2</sup><br>I <sub>1</sub> | 0000                    |
| 3344 030              |                    | 0000 N                  | 3350 080    |   | 000 N                   |
| 3344 215              |                    | 000 N                   | 3350 211    |   | 000 N                   |
| 3344 315              |                    | 00                      | 3350 347    |   | 2                       |
| 3344 521              | I <sub>1</sub>     | 0000 N                  | 3350 420    | D <sub>1</sub> <sup>2</sup><br>I <sub>1</sub> | 1                       |
| 3344 655              |                    | 2                       | 3350 512    |   | 1                       |
| 3344 721              |                    | 0000                    | 3350 545    |   | 1                       |
| 3344 831              |                    | 0000 N                  | 3350 648    |   | 2                       |
| 3344 924              | Z <sub>1</sub>     | 0                       | 3350 985    | Co I c  | 000                     |
| 3345 015              |                    | 000                     | 3351 080    |   | 000                     |
| 3345 068              | Z <sub>n</sub>     | 2                       | 3351 201    |   | 00                      |
| 3345 156              |                    | 2                       | 3351 280    |   | 0000                    |
| 3345 298              | Mn                 | 0000 N                  | 3351 370    | Co I c  | 0000                    |
| 3345 495              |                    | 00                      | 3351 472    |   | 0000                    |
| 3345 618              | Z <sub>n</sub>     | 000                     | 3351 551    |   | 0000                    |
| 3345 715              |                    | 1                       | 3351 658    |   | 2                       |
| 3345 761              | C <sub>1</sub> / n | 00                      | 3351 745    | I <sub>1</sub>                                | 0                       |
| 3345 835              |                    | 00                      | 3351 884    |   | 1                       |
| 3345 955              |                    | 000 N                   | 3352 101    |   | 0                       |
| 3346 047              |                    | 000 N                   | 3352 198    |   | 2                       |
| 3346 151              | C <sub>1</sub> / n | 0 N                     | 3352 318    | I <sub>1</sub> , Fe                           | 0000 N                  |
| 3346 284              |                    | 00                      | 3352 578    |   | 000 N                   |
| 3346 414              |                    | 00                      | 3352 771    |   | 00 N                    |
| 3346 557              |                    | 0                       | 3352 908    |   | 000                     |
| 3346 731              | C <sub>1</sub>     | 0000 N                  | 3352 958    | I c   | 000                     |
| 3346 800 <sup>1</sup> |                    | 1                       | 3353 065    |   | 1                       |
| 3346 904 <sup>1</sup> |                    | 2                       | 3353 262    |   | 2                       |
| 3347 066              |                    | 2                       | 3353 402    | Z <sub>1</sub>                                | 1                       |
| 3347 157              | Co                 | 0000                    | 3353 538    |   | 000 N                   |
| 3347 267              |                    | 0000 N                  | 3353 661    |   | 0000 N                  |
| 3347 450              |                    | 000                     | 3353 768    |   | 00 N                    |
| 3347 507              |                    | 000                     | 3353 875    | I c   | 4                       |
| 3347 638              | C <sub>1</sub>     | 0                       | 3354 057    |   | 000 N                   |
| 3347 760              |                    | 00 N                    | 3354 191    |   | 2                       |
| 3347 970 <sup>1</sup> |                    | 3                       | 3354 350    |   | 00 N                    |
| 3348 072 <sup>1</sup> | Fe                 | 3                       | 3354 523    | Co, Z <sub>1</sub>                            | 3                       |
| 3348 254              |                    | 1                       | 3354 670    |   | 00                      |
| 3348 370              |                    | 0000 N                  | 3354 778    |   | 3                       |
| 3348 520              |                    | 0000 N                  | 3355 023    |   | 00 N                    |
| 3348 673              | I <sub>1</sub>     | 000                     | 3355 197    | Fe  | 0000 N                  |
| 3348 820              |                    | 000                     | 3355 363    |   | 4                       |
| 3349 043              |                    | 4                       | 3355 497    |   | 0000 N                  |
| 3349 135              |                    | 3                       | 3355 661    | Mn  | 0                       |
| 3349 212              | I <sub>1</sub>     | 2                       | 3355 797    |   | 0000 N                  |
| 3349 399              |                    | 00                      | 3355 957    |   | 000 N                   |
| 3349 519              |                    | 2                       | 3356 080    |   | 000                     |
| 3349 597              | Cr                 | 7                       | 3356 231    | Z <sub>1</sub>                                | 1                       |
| 3349 695              |                    | 00                      | 3356 370    |   | 000 Nd <sup>2</sup>     |
| 3349 785              |                    | 00                      | 3356 462    |   | 2                       |
| 3349 874              |                    | 0                       | 3356 548    |   | 2                       |

<sup>1</sup> See note to 3335 299, etc.



| Wave length | Substance       | Intensity and Character | Wave length | Substance       | Intensity and Character |
|-------------|-----------------|-------------------------|-------------|-----------------|-------------------------|
| 3356 676    | Co              | 000 N                   | 3362 402    |                 | 2 d <sup>p</sup>        |
| 3356 821    | Fe              | 2                       | 3362 528    |                 | 0                       |
| 3356 976    |                 | 000                     | 3362 727    |                 | 0000                    |
| 3357 092    |                 | 0000                    | 3362 782    |                 | 1                       |
| 3357 256    |                 | 000 N                   | 3362 936    | Co              | 4 Nd <sup>p</sup>       |
| 3357 412    | Zr              | 2                       | 3363 107    |                 | 0                       |
| 3357 537    |                 | 1                       | 3363 298    |                 | 0000 N                  |
| 3357 703    |                 | 0                       | 3363 442    | Co              | 0 d <sup>p</sup>        |
| 3357 816    |                 | 0000                    | 3363 542    |                 | 1                       |
| 3357 874    |                 | 0                       | 3363 750    | Ni              | 1                       |
| 3357 959    |                 | 00                      | 3363 854    |                 | 1                       |
| 3358 076    |                 | 0000                    | 3363 955    | Co              | 0                       |
| 3358 182    |                 | 1 N                     | 3364 055    |                 | 0                       |
| 3358 276    |                 | 0000                    | 3364 148    |                 | 00                      |
| 3358 416    | Li              | 3                       | 3364 232    |                 | 0000                    |
| 3358 542    |                 | 00                      | 3364 302    |                 | 00                      |
| 3358 649    | Ti, Cu          | 4                       | 3364 408    | Co              | 1                       |
| 3358 771    |                 | 00                      | 3364 535    |                 | 0 Nd <sup>p</sup>       |
| 3358 832    |                 | 0                       | 3364 719    | Ni,             | 3 d <sup>p</sup>        |
| 3358 929    |                 | 00                      | 3364 832    |                 | 00                      |
| 3359 035    |                 | 2 N                     | 3365 081    |                 | 0000                    |
| 3359 144    |                 | 00                      | 3365 167    |                 | 0000                    |
| 3359 248    | Ni              | 3 N                     | 3365 247    |                 | 0000                    |
| 3359 420    | Co              | 1                       | 3365 341    |                 | 00                      |
| 3359 542    |                 | 1                       | 3365 451    |                 | 0000 N                  |
| 3359 636    | Fe <sup>p</sup> | 2                       | 3365 581    |                 | 0                       |
| 3359 769    |                 | 1                       | 3365 684    |                 | 00                      |
| 3359 823    |                 | 2                       | 3365 908    | Ni              | 6                       |
| 3359 936    |                 | 1 N                     | 3366 127    |                 | 000                     |
| 3360 066    |                 | 0                       | 3366 311    | Li, Ni          | 6 d <sup>p</sup>        |
| 3360 181    |                 | 2                       | 3366 491    |                 | 000                     |
| 3360 258    |                 | 0                       | 3366 594    |                 | 000                     |
| 3360 345    |                 | 0                       | 3366 687    |                 | 0000                    |
| 3360 444    | Ni              | 2                       | 3366 791    |                 | 0000 N                  |
| 3360 485    | Cu              | 1                       | 3366 931    | Ni, Li          | 3                       |
| 3360 631    |                 | 0                       | 3367 009    | Fe              | 3                       |
| 3360 741    |                 | 0                       | 3367 117    |                 | 000                     |
| 3360 828    |                 | 0                       | 3367 233    | Co              | 2                       |
| 3360 988    |                 | 0                       | 3367 207    | Fe <sup>p</sup> | 1                       |
| 3361 055    | Ti              | 1                       | 3367 434    |                 | 00                      |
| 3361 141    |                 | 0                       | 3367 527    |                 | 0000                    |
| 3361 241    |                 | 1                       | 3367 575    |                 | 0                       |
| 3361 327    | Li              | 8                       | 3367 687    |                 | 0                       |
| 3361 421    |                 | 2                       | 3367 812    |                 | 0                       |
| 3361 568    |                 | 0 N                     | 3367 953    |                 | 000                     |
| 3361 704    | Co,             | 3 Nd <sup>p</sup>       | 3368 029    | Li, Ni, Fe      | 2                       |
| 3361 906    |                 | 1                       | 3368 193    | Cu,             | 5 d <sup>p</sup>        |
| 3361 988    |                 | 0                       | 3368 319    | Mn              | 1                       |
| 3362 087    | Ti              | 2                       | 3368 382    |                 | 000                     |
| 3362 275    |                 | 1                       | 3368 496    |                 | 000                     |

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3368 580    |           | 0000                    | 3374 271    |           | 000                     |
| 3368 680    |           | 00                      | 3374 358    | Ni        | 4                       |
| 3368 793    |           | 00                      | 3374 487    | Li, Co    | 2                       |
| 3368 860    |           | 00                      | 3374 588    | Fe        | 1                       |
| 3368 956    |           | 0                       | 3374 778    | Ni        | 2                       |
| 3369 083    |           | 3 d?                    | 3374 872    | /i        | 1                       |
| 3369 190    |           | 0                       | 3374 981    |           | 000                     |
| 3369 286    |           | 0                       | 3375 068    |           | 0                       |
| 3369 352    | Li, Mn    | 1                       | 3375 231    |           | 00                      |
| 3369 506    |           | 0 N                     | 3375 351    |           | 0000                    |
| 3369 633    |           | 0                       | 3375 478    |           | 0 N                     |
| 3369 713    | Fe, Ni    | 6                       | 3375 601    |           | 0000                    |
| 3369 800    |           | 1                       | 3375 696    | Ni        | 1                       |
| 3369 932    |           | 0                       | 3375 768    |           | 000                     |
| 3370 052    |           | 0                       | 3375 866    |           | 0                       |
| 3370 173    |           | 00                      | 3375 991    |           | 0000                    |
| 3370 330    |           | 0 N                     | 3376 081    |           | 0000                    |
| 3370 468    | Co        | 2                       | 3376 164    |           | 00                      |
| 3370 584    | Li        | 2                       | 3376 238    |           | 000                     |
| 3370 770    | Zr, Mn    | 1 Nd'                   | 3376 341    |           | 0000                    |
| 3370 933    | Fe        | 4                       | 3376 414    |           | 0                       |
| 3371 020    |           | 000                     | 3376 471    | La        | 2                       |
| 3371 110    |           | 0                       | 3376 630    | Fe        | 2                       |
| 3371 246    |           | 00                      | 3376 731    |           | 0000                    |
| 3371 296    |           | 00                      | 3376 811    |           | 0000                    |
| 3371 431    |           | 0                       | 3376 894    |           | 000                     |
| 3371 535    |           | 00                      | 3376 978    |           | 000                     |
| 3371 593    | Li        | 3                       | 3377 081    |           | 0000                    |
| 3371 745    |           | 000                     | 3377 202    | (o)       | 0 N                     |
| 3371 852    |           | 00                      | 3377 108    |           | 00                      |
| 3371 899    |           | 00                      | 3377 197    |           | 0000                    |
| 3372 124    | Ni, Fe    | 4                       | 3377 622 }  | Li        | 3                       |
| 3372 225    |           | 1                       | 3377 723 }  | Li        | 3                       |
| 3372 314    |           | 0                       | 3377 837    |           | 0000 N                  |
| 3372 362    | Li        | 2                       | 3377 913    |           | 0000 N                  |
| 3372 488    | Fe        | 0                       | 3378 114    |           | 1                       |
| 3372 609    | Fe        | 00 N                    | 3378 203    |           | 000                     |
| 3372 759    |           | 0 N                     | 3378 320    |           | 00                      |
| 3372 901    |           | { 5                     | 3378 476    | (i, Co?)  | 2                       |
| 3372 994    | Li Pd     | { 5                     | 3378 723    |           | 00                      |
| 3373 105    |           | 0 N                     | 3378 824    | Fe        | 2                       |
| 3373 229    |           | 000                     | 3378 881    | Co        | 1                       |
| 3373 369    | Co        | 0                       | 3379 005    | Mn        | 0 N                     |
| 3373 452    |           | 0                       | 3379 161    | Fe        | 2                       |
| 3373 555    | /i        | 0                       | 3379 337    | Th, Cl    | 2 d?                    |
| 3373 642    |           | 0                       | 3379 514    | Cl        | 2                       |
| 3373 742    |           | 0000                    | 3379 577    |           | 000                     |
| 3373 872    |           | 0000                    | 3379 687    |           | 0000                    |
| 3374 016    | Fe        | 1                       | 3379 783    |           | 0000                    |
| 3374 119    |           | 2                       | 3379 843    |           | 0000                    |

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3368 580    |           | 0000                    | 3374 271    |           | 000                     |
| 3368 680    |           | 00                      | 3374 358    |           | 4                       |
| 3368 793    |           | 00                      | 3374 487    | Ni        | 2                       |
| 3368 860    |           | 00                      | 3374 588    | I, Co     | 2                       |
| 3368 956    |           | 0                       | 3374 778    | Fe        | 1                       |
| 3369 083    |           | 3 d <sup>2</sup>        | 3374 872    | Ni        | 2                       |
| 3369 190    |           | 0                       | 3374 981    | Zr        | 1                       |
| 3369 286    |           | 0                       | 3375 068    |           | 000                     |
| 3369 352    | I, Mn     | 1                       | 3375 231    |           | 0                       |
| 3369 506    |           | 0 N                     | 3375 351    |           | 00                      |
| 3369 633    |           | 0                       | 3375 478    |           | 0000                    |
| 3369 713    | Fe, Ni    | 6                       | 3375 601    |           | 0 N                     |
| 3369 800    |           | 1                       | 3375 698    | Ni        | 0000                    |
| 3369 932    |           | 0                       | 3375 768    |           | 1                       |
| 3370 052    |           | 0                       | 3375 866    |           | 000                     |
| 3370 173    |           | 00                      | 3375 991    |           | 0                       |
| 3370 330    |           | 0 N                     | 3376 081    |           | 0000                    |
| 3370 468    | Co        | 2                       | 3376 164    |           | 0000                    |
| 3370 584    | I         | 2                       | 3376 238    |           | 00                      |
| 3370 770    | Zr, Mn    | 1 Nd <sup>2</sup>       | 3376 341    |           | 000                     |
| 3370 933    | Fe        | 4                       | 3376 414    |           | 0000                    |
| 3371 020    |           | 000                     | 3376 471    | I, Fe     | 0                       |
| 3371 110    |           | 0                       | 3376 630    |           | 2                       |
| 3371 246    |           | 00                      | 3376 731    |           | 0000                    |
| 3371 296    |           | 00                      | 3376 814    |           | 0000                    |
| 3371 431    |           | 0                       | 3376 894    |           | 000                     |
| 3371 535    |           | 00                      | 3376 978    |           | 000                     |
| 3371 593    | I         | 3                       | 3377 084    |           | 0000                    |
| 3371 745    |           | 000                     | 3377 202    | Co        | 0 N                     |
| 3371 852    |           | 00                      | 3377 408    |           | 00                      |
| 3371 899    |           | 00                      | 3377 497    |           | 0000                    |
| 3372 124    | Ni, Fe    | 4                       | 3377 622    | Ti        | 3                       |
| 3372 225    |           | 1                       | 3377 723    | I         | 3                       |
| 3372 314    |           | 0                       | 3377 837    |           | 0000 N                  |
| 3372 362    | I         | 2                       | 3377 943    |           | 0000 N                  |
| 3372 488    | Fe        | 0                       | 3378 114    |           | 1                       |
| 3372 609    | Fe        | 00 N                    | 3378 203    |           | 000                     |
| 3372 759    |           | 0 N                     | 3378 320    |           | 00                      |
| 3372 901    | Ti Pd     | { 5                     | 3378 476    | Ci, Co?   | 2                       |
| 3372 994    |           | { 5                     | 3378 723    |           | 00                      |
| 3373 105    |           | 0 N                     | 3378 824    | Fe        | 2                       |
| 3373 229    |           | 000                     | 3378 881    | Co        | 1                       |
| 3373 369    | Co        | 0                       | 3379 005    | Mn        | 0 N                     |
| 3373 452    |           | 0                       | 3379 161    | Fe        | 2                       |
| 3373 555    | Zi        | 0                       | 3379 337    | I, Ci     | 2 d <sup>2</sup>        |
| 3373 642    |           | 0                       | 3379 514    | Ci        | 2                       |
| 3373 742    |           | 0000                    | 3379 577    |           | 000                     |
| 3373 872    |           | 0000                    | 3379 687    |           | 0000                    |
| 3374 016    | Fe        | 1                       | 3379 783    |           | 0000                    |
| 3374 119    |           | 2                       | 3379 843    |           | 0000                    |

| Wave length           | Substance          | Intensity and Character | Wave length | Substance                     | Intensity and Character |
|-----------------------|--------------------|-------------------------|-------------|-------------------------------|-------------------------|
| 3379 961              | Cr                 | 3                       | 3385 577    | Fe                            | 1                       |
| 3380 060              | Zr, I <sub>1</sub> | 1                       | 3385 688    | Fe                            | 1                       |
| 3380 157              |                    | 0000                    | 3385 809    | I <sub>1</sub>                | 1                       |
| 3380 255              | Fe                 | 3                       | 3385 861    | Fe?                           | 00                      |
| 3380 397 <sup>*</sup> | I <sub>1</sub>     | 3                       | 3386 005    |                               | 0000 N                  |
| 3380 450 <sup>*</sup> |                    | 3                       | 3386 085    | I <sub>1</sub> , Mn           | 3                       |
| 3380 605              |                    | 0                       | 3386 310    |                               | 00 N                    |
| 3380 722              | Ni                 | 6 N                     | 3386 408    |                               | 000                     |
| 3380 889              | Si?                | 1                       | 3386 488    |                               | 000                     |
| 3381 026              | Ni, I a            | 5 Nd?                   | 3386 588    |                               | 000                     |
| 3381 202              |                    | 0000                    | 3386 691    |                               | 00 N                    |
| 3381 269              |                    | 1                       | 3386 875    |                               | 000                     |
| 3381 490              | Fe                 | 2                       | 3386 921    |                               | 000                     |
| 3381 632              |                    | 000                     | 3387 014    |                               | 000                     |
| 3381 669              |                    | 000                     | 3387 194    |                               | 000 N                   |
| 3381 786              |                    | 0000                    | 3387 307    |                               | 000                     |
| 3381 896              |                    | 000                     | 3387 444    |                               | 0                       |
| 3382 002              |                    | 000                     | 3387 554    | Fe                            | 2                       |
| 3382 129              | Mn                 | 0                       | 3387 600    |                               | 0                       |
| 3382 224              |                    | 00 N                    | 3387 762    | Fe                            | 1                       |
| 3382 340              |                    | 0                       | 3387 854    |                               | 00                      |
| 3382 450              | I <sub>1</sub>     | 1                       | 3387 988    | I <sub>1</sub> / <sub>1</sub> | 5 d?                    |
| 3382 549              | Fe                 | 2                       | 3388 190    |                               | 0000                    |
| 3382 604              | Di?                | 1                       | 3388 311    | Co                            | 3                       |
| 3382 724              |                    | 000                     | 3388 473    | / <sub>1</sub>                | 1                       |
| 3382 825              | Cr, Mn             | 4                       | 3388 604    |                               | 0 N                     |
| 3382 926              |                    | 0000                    | 3388 761    | I a?                          | 1                       |
| 3383 036              |                    | 00                      | 3388 896    | I <sub>1</sub>                | 2                       |
| 3383 129              |                    | 0                       | 3388 994    |                               | 00                      |
| 3383 232              |                    | 0000 N                  | 3389 107    |                               | 1                       |
| 3383 342              |                    | 0000 N                  | 3389 257    |                               | 000                     |
| 3383 449              | Ag                 | 000                     | 3389 387    |                               | 00                      |
| 3383 512              |                    | 0                       | 3389 460    |                               | 00                      |
| 3383 629              |                    | 000 N                   | 3389 540    |                               | 0                       |
| 3383 709              |                    | 0                       | 3389 747    |                               | 0000 N                  |
| 3383 833              | Fe                 | 3                       | 3389 884 s  | Fe                            | 2                       |
| 3383 951              | I <sub>1</sub>     | 3                       | 3389 960    |                               | 0000                    |
| 3384 133              | Fe                 | 3                       | 3390 060    |                               | 0000                    |
| 3384 225              |                    | 00                      | 3390 154    |                               | 000                     |
| 3384 375              |                    | 000                     | 3390 244    |                               | 000 Nd?                 |
| 3384 461              |                    | 000                     | 3390 400    |                               | 00                      |
| 3384 561              |                    | 000                     | 3390 544    |                               | 00                      |
| 3384 728              |                    | 0000 N                  | 3390 654    |                               | 000                     |
| 3384 782              |                    | 00                      | 3390 736    |                               | 000                     |
| 3384 908              |                    | 1                       | 3390 819    | I <sub>1</sub>                | 0                       |
| 3385 061              |                    | 0000                    | 3390 919    |                               | 00                      |
| 3385 167              |                    | 0                       | 3391 033    |                               | 00 N                    |
| 3385 215              |                    | 000                     | 3391 175    | Ni                            | 5                       |
| 3385 361              | Co                 | 3                       | 3391 243    |                               | 1 N                     |
| 3385 468              |                    | 0000                    | 3391 409    |                               | 0000 N                  |

<sup>\*</sup> See note to 3335 299, etc

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3391 509    | Cr        | 0000 N                  | 3397 451    | V?        | 0000                    |
| 3391 578    |           | 2                       | 3397 571    |           | 00                      |
| 3391 726    |           | 0                       | 3397 691    |           | 1                       |
| 3391 806    |           | 0000 N                  | 3397 779    |           | 2                       |
| 3391 977    | Zn        | 0                       | 3397 931    | Fe        | 00                      |
| 3392 109    |           | 2                       | 3397 974    |           | 000                     |
| 3392 153    | Fe        | 1                       | 3398 151    |           | 0000 N                  |
| 3392 259    | Cu        | 0                       | 3398 244    |           | 0000 N                  |
| 3392 441    |           | 3                       | 3398 357    | Fe        | 1                       |
| 3392 633    | Fe        | 00 N                    | 3398 441    |           | 00                      |
| 3392 759    |           | 2                       | 3398 511    |           | 0                       |
| 3392 813    | Li        | 1                       | 3398 551    |           | 0000 N                  |
| 3392 926    |           | 0                       | 3398 746    | Li        | 00 N                    |
| 3393 029    | Ni        | 0                       | 3398 839    |           | 000                     |
| 3393 113    |           | 3                       | 3398 949    |           | 000                     |
| 3393 160    | Cu        | 1                       | 3399 059    |           | 0                       |
| 3393 285    | Zn        | 1                       | 3399 126    | Fe, Zn    | 0000                    |
| 3393 427    | Fe        | 0                       | 3399 294    |           | 00                      |
| 3393 526    |           | 1                       | 3399 376    |           | 2                       |
| 3393 845    | Cu        | 1 Nd?                   | 3399 489    |           | 3                       |
| 3393 980    |           | 2                       | 3399 654    | Fe        | 0                       |
| 3394 062    | Cu        | 1                       | 3399 746    |           | 0000                    |
| 3394 220    | Fe        | 1                       | 3399 942    |           | 0 N                     |
| 3394 432    | Cu        | 2                       | 3400 153    |           | 0000 N                  |
| 3394 518    |           | 0                       | 3400 279    | Ni        | 000                     |
| 3394 685    | Li        | 3                       | 3400 366    |           | 0000                    |
| 3394 746    | Fe        | 3                       | 3400 549    |           | 000                     |
| 3394 875    | Co        | 0000                    | 3400 620    |           | 0000                    |
| 3394 958    |           | 0000                    | 3400 770    | Fe        | 1                       |
| 3395 085    |           | 0000 N                  | 3400 970    |           | 0000                    |
| 3395 212    |           | 0                       | 3401 121    | Ni        | 1                       |
| 3395 408    | Co        | 00 N                    | 3401 307    |           | 1                       |
| 3395 505    |           | 3                       | 3401 478    |           | 000                     |
| 3395 544    |           | 2                       | 3401 664    | Fe        | 3                       |
| 3395 750    |           | 0                       | 3401 778    |           | 0000 N                  |
| 3395 882    | Ni        | 0                       | 3401 900    |           | 0                       |
| 3396 012    |           | 000                     | 3401 992    | Fe        | 000                     |
| 3396 125    |           | 0                       | 3402 058    |           | 000                     |
| 3396 178    |           | 0                       | 3402 208    |           | 000                     |
| 3396 320    | Ni        | 1                       | 3402 262    |           | 000                     |
| 3396 437    |           | 0                       | 3402 352    | Fe        | 000                     |
| 3396 523    |           | 0                       | 3402 400    |           | 3                       |
| 3396 642    | Fe        | 000                     | 3402 553    |           | 3                       |
| 3396 742    |           | 0000                    | 3402 685    |           | 0                       |
| 3396 792    |           | 00                      | 3402 842    | Li        | 0000                    |
| 3396 965    |           | 0000                    | 3402 925    |           | 000                     |
| 3397 062    | Fe        | 0000                    | 3403 033    |           | 0                       |
| 3397 116    |           | 3                       | 3403 145    |           | 0000 N                  |
| 3397 197    |           | 0000                    | 3403 288    | Cu        | 0000 N                  |
| 3397 356    |           | 1                       | 3403 401    |           | 2                       |

| Wave length  | Substance          | Intensity and Character | Wave length | Substance      | Intensity and Character |
|--------------|--------------------|-------------------------|-------------|----------------|-------------------------|
| 3403 478     | Fe, I <sub>1</sub> | 2                       | 3409 346    | Fe             | 2                       |
| 3403 572     | Ni                 | 2                       | 3409 530    |                | 000 N                   |
| 3403 725     |                    | 000 N                   | 3409 711    | Ni             | 2                       |
| 3403 826     |                    | 0                       | 3409 803    |                | 0                       |
| 3403 925     |                    | 0000                    | 3409 950    | I <sub>1</sub> | 2                       |
| 3404 005     |                    | 0000                    | 3410 080    |                | 00                      |
| 3404 128     |                    | 0000                    | 3410 170    |                | 1                       |
| 3404 202     |                    | 000 N                   | 3410 313    | Fe             | 2                       |
| 3404 292     |                    | 0000                    | 3410 386    | Zi             | 1                       |
| 3404 413     | Fe                 | 2                       | 3410 526    |                | 0000 N                  |
| 3404 511     | Fe                 | 3                       | 3410 696    |                | 00                      |
| 3404 581     |                    | 0000 N                  | 3410 783    |                | 0000 N                  |
| 3404 717     | Pd                 | 0                       | 3410 923    |                | 00                      |
| 3404 897     |                    | 1                       | 3411 035    | Fe             | 2                       |
| 3404 972     | Zr                 | 0                       | 3411 160    |                | 00 Nd?                  |
| 3405 044     | C?                 | 0                       | 3411 274    | Fe             | 1                       |
| 3405 097     |                    | 00                      | 3411 366    |                | 0000                    |
| 3405 217 } s | Co                 | 2                       | 3411 498    | Fe             | 3                       |
| 3405 302 } s |                    | 2                       | 3411 700    |                | 0000                    |
| 3405 504     |                    | 000                     | 3411 883    |                | 000                     |
| 3405 637     |                    | 0000                    | 3412 009    |                | 000                     |
| 3405 716     | Fe                 | 0                       | 3412 109    |                | 000                     |
| 3405 837     |                    | 0000 N                  | 3412 162    |                | 0000                    |
| 3405 971     | Fe                 | 1                       | 3412 302    |                | 0000 N                  |
| 3406 111     |                    | 000 N                   | 3412 481    | Co             | 5                       |
| 3406 254     |                    | 00                      | 3412 595    |                | 0000                    |
| 3406 304     |                    | 00                      | 3412 775    | Co             | 4                       |
| 3406 391     |                    | 0000                    | 3412 909    |                | 0000 N                  |
| 3406 491     |                    | 0000                    | 3413 019    |                | 000                     |
| 3406 572 s   | Fe                 | 3                       | 3413 275    | Fe             | 5 d?                    |
| 3406 697     |                    | 0                       | 3413 402    |                | 000 N                   |
| 3406 943 s   | Fe                 | 5 d?                    | 3413 542    |                | 00                      |
| 3407 187     |                    | 000                     | 3413 597    | Ni             | 2                       |
| 3407 338     | Ti                 | 2                       | 3413 651    |                | 2                       |
| 3407 447     |                    | 2                       | 3413 782    |                | 0                       |
| 3407 537     |                    | 00                      | 3413 855    |                | 00                      |
| 3407 597     | Fe                 | 4                       | 3413 935    |                | 0000                    |
| 3407 693     |                    | 3                       | 3414 079    | Ni             | 4                       |
| 3407 844     |                    | 0000 N                  | 3414 269    |                | 00 N                    |
| 3407 937     | Di?                | 0                       | 3414 399    |                | 000 N                   |
| 3408 091     |                    | 00 Nd?                  | 3414 535    |                | 000 N                   |
| 3408 217     |                    | 0                       | 3414 643    |                | 1                       |
| 3408 317     |                    | 0000 N                  | 3414 769    |                | 1                       |
| 3408 484     |                    | 0000 N                  | 3414 911    | Ni             | 15                      |
| 3408 637     |                    | 000 Nd?                 | 3415 050    |                | 1 Nd?                   |
| 3408 811     |                    | 000 N                   | 3415 230    |                | 0                       |
| 3408 911     | Cr                 | 3                       | 3415 279    |                | 00                      |
| 3409 070     |                    | 1                       | 3415 462    |                | 0000 N                  |
| 3409 210     |                    | 0000                    | 3415 575    |                | 0000                    |
| 3409 302     | Co                 | 2                       | 3415 672    | Fe             | 3                       |

| Wave length | Substance       | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------------|-------------------------|-------------|-----------|-------------------------|
| 3415 815    |                 | 0                       | 3422 033    |           | 0000                    |
| 3415 922    |                 | 00 N                    | 3422 087    |           | 0000                    |
| 3416 029    |                 | 0000                    | 3422 260    |           | I                       |
| 3416 164    |                 | 3                       | 3422 347    |           | 0000                    |
| 3416 274    |                 | 0000                    | 3422 468    | Ni        | I                       |
| 3416 421    |                 | I                       | 3422 629    | Fe        | 4                       |
| 3416 541    |                 | 0000                    | 3422 794    | Fe        | 3                       |
| 3416 644    |                 | 000 N                   | 3422 892    | Cl        | 4                       |
| 3416 771    |                 | 00                      | 3423 016    | Ni        | I                       |
| 3416 808    |                 | 0                       | 3423 153    |           | 0000 N                  |
| 3416 914    |                 | 00                      | 3423 307    |           | 000 N                   |
| 3417 001    |                 | 00                      | 3423 380    |           | 00 N                    |
| 3417 095    | Ti              | I                       | 3423 453    |           | 000 N                   |
| 3417 198    |                 | 00                      | 3423 667    |           | 00 N                    |
| 3417 301    | Co              | 3                       | 3423 760    |           | 0 N                     |
| 3417 401    | Fe              | I                       | 3423 848    | Ni        | 7                       |
| 3417 491    |                 | 000                     | 3423 972    |           | 0 N                     |
| 3417 618    |                 | 0000                    | 3424 127    |           | 0                       |
| 3417 681    |                 | 0000                    | 3424 311    |           | 00                      |
| 3417 819    | Co              | 00                      | 3424 432    | Fe        | 4                       |
| 3417 948    | Fe              | 2                       | 3424 579    |           | 0000 N                  |
| 3418 002    |                 | 2                       | 3424 646    | Co        | 0                       |
| 3418 161    |                 | 0000                    | 3424 732    |           | 000                     |
| 3418 303    | Fe              | I                       | 3424 846    |           | 000                     |
| 3418 448    |                 | 0000 N                  | 3424 966    | /1        | 00                      |
| 3418 654    | Fe              | 5                       | 3425 152    | Fe        | 4                       |
| 3418 864    |                 | 000 N                   | 3425 196    |           | 000                     |
| 3419 013    |                 | I                       | 3425 432    |           | 0000 N                  |
| 3419 108    |                 | 0000 N                  | 3425 579    |           | 0000 N                  |
| 3419 282    | Fe              | I                       | 3425 716 s  |           | 2                       |
| 3419 424    |                 | 000 N                   | 3425 879    |           | 0000 N                  |
| 3419 554    |                 | 000 N                   | 3425 976    |           | 00                      |
| 3419 836    | Fe              | 2                       | 3426 102    |           | 000                     |
| 3420 013    |                 | 000                     | 3426 226    |           | 000                     |
| 3420 133    |                 | 000                     | 3426 349    |           | 0000                    |
| 3420 240    |                 | 00                      | 3426 466    | Fe        | 3                       |
| 3420 360    |                 | 000                     | 3426 535    | Fe        | 3                       |
| 3420 417    |                 | 00                      | 3426 769    | Fe        | 3                       |
| 3420 575    |                 | 0                       | 3426 897    |           | 2                       |
| 3420 620    |                 | 00                      | 3426 929    |           | 0000                    |
| 3420 730    |                 | 000                     | 3427 046    |           | 0000                    |
| 3420 880    | Ni <sup>9</sup> | 2                       | 3427 126    | Fe?       | 2                       |
| 3420 940    | Mn              | 00                      | 3427 263 s  | Fe        | 3                       |
| 3421 147    |                 | 000                     | 3427 340    |           | I                       |
| 3421 253    |                 | 0000 N                  | 3427 492    |           | 0000                    |
| 3421 353    | Ni, Cr, Pd      | 4                       | 3427 596    |           | 0000                    |
| 3421 482    | Ni              | 2                       | 3427 656    |           | 00                      |
| 3421 620    |                 | 0000 N                  | 3427 746    |           | 0000 N                  |
| 3421 758    | Co              | 0                       | 3427 899    |           | 000 N                   |
| 3421 860    |                 | 0                       | 3427 972    |           | 000 N                   |

| Wave-length | Substance | Intensity and Character | Wave length | Substance      | Intensity and Character |
|-------------|-----------|-------------------------|-------------|----------------|-------------------------|
| 3428 082    | Fe, Co    | 0000 N                  | 3434 117    | Cr             | 0000                    |
| 3428 154    |           | 0                       | 3434 183    |                | 0                       |
| 3428 341    |           | 4                       | 3434 259    |                | 0                       |
| 3428 459    |           | 0000                    | 3434 383    |                | 0000                    |
| 3428 561    |           | 1                       | 3434 512    |                | 000                     |
| 3428 626    |           | 1                       | 3434 626    |                | 0000                    |
| 3428 776    |           | 000                     | 3434 746    |                | 0000                    |
| 3428 892    |           | 2                       | 3434 829    |                | 0000                    |
| 3429 066    |           | 000                     | 3434 962    |                | 000                     |
| 3429 172    |           | 0000                    | 3435 032    |                | 000                     |
| 3429 282    | Co        | 0000 N                  | 3435 102    | Cr             | 00                      |
| 3429 468    |           | 00                      | 3435 179    |                | 0000 N                  |
| 3429 605    |           | 0000                    | 3435 296    |                | 000 N                   |
| 3429 718    |           | 0000 N                  | 3435 382    |                | 000 N                   |
| 3429 851    |           | 00                      | 3435 509    |                | 0000 N                  |
| 3429 951    |           | 000                     | 3435 628    |                | 1                       |
| 3430 071    |           | 0000 Nd?                | 3435 729    |                | 00                      |
| 3430 218    |           | 0000 N                  | 3435 819    |                | 0                       |
| 3430 295    |           | 000                     | 3435 962    |                | 0 N                     |
| 3430 428    |           | 00                      | 3436 174    |                | 1                       |
| 3430 545    | Zr        | 00 N                    | 3436 250    | Cr             | 0                       |
| 3430 671    |           | 1                       | 3436 332    |                | 2                       |
| 3430 777    |           | 0000 N                  | 3436 472    |                | 0000 N                  |
| 3430 870    |           | 0000 N                  | 3436 552    |                | 000 N                   |
| 3431 020    |           | 000                     | 3436 666    |                | 0000 N                  |
| 3431 090    |           | 000                     | 3436 786    |                | 0000                    |
| 3431 207    |           | 0000                    | 3436 882    |                | 000                     |
| 3431 320    |           | 0000                    | 3436 976    |                | 0000 N                  |
| 3431 423    |           | 00                      | 3437 116    |                | 000 N                   |
| 3431 590    |           | 0000 N                  | 3437 190    | Fe<br>Zr<br>Ni | 3                       |
| 3431 721    | Co        | 4                       | 3437 282    |                | 00                      |
| 3431 830    |           | 000                     | 3437 427    |                | 5 d?                    |
| 3431 965    | Fe        | 3                       | 3437 616    | Fe             | 0000Nd?                 |
| 3432 077    |           | 000                     | 3437 772    |                | 00                      |
| 3432 157    |           | 0                       | 3437 829    |                | 00                      |
| 3432 270    | Co        | 000                     | 3437 926    | Fe             | 0000                    |
| 3432 350    |           | 0000                    | 3438 012    |                | 0000                    |
| 3432 447    |           | 0                       | 3438 094    |                | 2                       |
| 3432 550    |           | 00                      | 3438 236    | Zr             | 000                     |
| 3432 707    |           | 0000                    | 3438 376    |                | 2                       |
| 3432 863    |           | 0                       | 3438 455    | Fe             | 1                       |
| 3433 023    |           | 000                     | 3438 556    |                | 0000 N                  |
| 3433 163    |           | 3                       | 3438 639    |                | 000 N                   |
| 3433 212    | Cr, C?    | 2                       | 3438 851    | Mn?            | 000 N                   |
| 3433 290    |           | 0000                    | 3439 092    |                | 2                       |
| 3433 453    |           | 3                       | 3439 171    |                | 2                       |
| 3433 591    | Pd<br>Cr  | 0                       | 3439 268    | Fe             | 0000 N                  |
| 3433 715    |           | 8 d?                    | 3439 365    |                | 000 N                   |
| 3433 905    |           | 0 N                     | 3439 478    |                | 00Nd?                   |
| 3434 053    |           | 0000                    | 3439 635    |                | 000 N                   |



# PRELIMINARY TABLE OF SOLAR SPECTRUM WAVE-LENGTHS XVII

By HENRY A ROWLAND

| Wave length | Substance | Intensity<br>and<br>Character | Wave length | Substance | Intensity<br>and<br>Character |
|-------------|-----------|-------------------------------|-------------|-----------|-------------------------------|
| 3439 735    |           | ooo N                         | 3444 217    |           | oooo                          |
| 3439 841    |           | oooo                          | 3444 402    | Ni?       | 2                             |
| 3439 941    |           | oooo                          | 3444 467    | Ti        | 4                             |
| 3440 008    | Fe        | 3                             | 3444 590    |           | oooo N                        |
| 3440 138    |           | ooo N                         | 3444 654    |           | 0                             |
| 3440 235    |           | oo N                          | 3444 774    |           | oooo                          |
| 3440 328    |           | ooo N                         | 3444 847    |           | oo                            |
| 3440 505    |           | o N                           | 3445 030    |           | ooo Nd?                       |
| 3440 635    |           | ooo N                         | 3445 260    | Fe        | 5                             |
| 3440 762 s  | Fe        | 20                            | 3445 477    |           | ooo N                         |
| 3440 875    |           | oo N                          | 3445 597    |           | ooo N                         |
| 3441 021    |           | ooo N                         | 3445 741    | Fe, Cr    | 2 N                           |
| 3441 155 s  | Fe        | 15                            | 3445 905    | Fe        | 2                             |
| 3441 248    |           | ooo N                         | 3445 947    |           | oooo                          |
| 3441 391    |           | o Na?                         | 3446 127    |           | oooo                          |
| 3441 588    | Cr        | 1 N                           | 3446 240    |           | 1                             |
| 3441 688    | Pd        | oooo N                        | 3446 314    |           | ooo                           |
| 3441 808    |           | oooo N                        | 3446 406    | Ni        | 15                            |
| 3441 875    |           | ooo                           | 3446 536    |           | 1 Nd?                         |
| 3442 035    |           | oooo                          | 3446 620    |           | oooo N                        |
| 3442 118    | Mn        | 6                             | 3446 747    |           | oooo N                        |
| 3442 188    | Ni        | 1                             | 3446 857    |           | ooo                           |
| 3442 284    |           | 1                             | 3446 931    |           | oo                            |
| 3442 368    |           | oo                            | 3447 089    |           | 0                             |
| 3442 503    | Fe        | 2                             | 3447 154    |           | oo N                          |
| 3442 696    | Ni        | 0                             | 3447 290    |           | oooo N                        |
| 3442 813    | Fe        | 3                             | 3447 420    | Fe, Co    | 4                             |
| 3442 921    |           | oooo                          | 3447 569    | Cr        | 0                             |
| 3443 059    | Co        | 2                             | 3447 674    |           | oooo N                        |
| 3443 101    | Fe        | 1                             | 3447 774    |           | ooo                           |
| 3443 181    |           | oo                            | 3447 901    | Cr        | 0                             |
| 3443 330    | Co        | 0                             | 3448 040    |           | oooo N                        |
| 3443 435    |           | ooo N                         | 3448 144    |           | 1                             |
| 3443 517    |           | 1                             | 3448 227    |           | oooo                          |
| 3443 575    |           | oooo N                        | 3448 340    |           | o Nd?                         |
| 3443 691    |           | oooo                          | 3448 494    |           | ooo N                         |
| 3443 791    | Co        | 5 d?                          | 3448 597    |           | ooo N                         |
| 3443 908    |           | oo N                          | 3448 727    |           | ooo N                         |
| 3444 020 s  | Fe        | 8 N                           | 3448 827    |           | oooo N                        |
| 3444 127    |           | o N                           | 3448 926    |           | 0                             |

| Wave length           | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-----------------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3449 003              |           | 0                       | 3455 736    | Cr        | 0                       |
| 3449 099              |           | 0000                    | 3455 828    |           | 0000 N                  |
| 3449 186              |           | 0000                    | 3455 928    |           | 0000Nd?                 |
| 3449 310              | Co        | 5 d?                    | 3456 081    |           | 0000                    |
| 3449 446              |           | 0000                    | 3456 148    |           | 00                      |
| 3449 583              | Co        | 6 d?                    | 3456 228    |           | 000                     |
| 3449 766              |           | 0000 N                  | 3456 383    | Fe        | 0                       |
| 3449 833              |           | 0000 N                  | 3456 528    | Ti        | 3                       |
| 3449 996              |           | 000 Nd?                 | 3456 634    |           | 0000 N                  |
| 3450 123              |           | 000 Nd?                 | 3456 714    |           | 0000 N                  |
| 3450 275              |           | 00                      | 3456 801    | Ti        | 00 N                    |
| 3450 373              |           | 0000 N                  | 3456 944    |           | 000 N                   |
| 3450 469              | Fe        | 5                       | 3457 068    | Co        | 1                       |
| 3450 589              |           | 0000 N                  | 3457 230    | Fe        | 2                       |
| 3450 742              |           | 0000 N                  | 3457 281    |           | 00                      |
| 3450 882              |           | 0000 N                  | 3457 414    |           | 0000 N                  |
| 3450 995              |           | 000 N                   | 3457 538    |           | 0000 N                  |
| 3451 129              |           | 0000                    | 3457 648    | Fe, Zr    | 0                       |
| 3451 255              |           | 00                      | 3457 708    |           | 0                       |
| 3451 369              |           | 0000                    | 3457 758    |           | 000                     |
| 3451 477              |           | 0                       | 3457 908    |           | 0000 N                  |
| 3451 609              | Mn        | 0                       | 3458 028    |           | 0                       |
| 3451 761              | Fe        | 2                       | 3458 144    |           | 000                     |
| 3451 915              |           | 0000 N                  | 3458 254    |           | 0                       |
| 3452 057              | Fe        | 3                       | 3458 442    | Fe        | 3                       |
| 3452 419              | Fe        | 4                       | 3458 601    | Ni        | 8                       |
| 3452 609              | Ti        | 1                       | 3458 728    |           | 0 N                     |
| 3452 762              |           | 000                     | 3458 834    |           | 0 Nd?                   |
| 3452 919              |           | 00 N                    | 3459 074    | Zr        | 00                      |
| 3453 039              | Ni        | 6 d?                    | 3459 194    |           | 0000                    |
| 3453 169              | Fe        | 2                       | 3459 288    |           | 000                     |
| 3453 255              |           | 000                     | 3459 414    |           | 000                     |
| 3453 355              | La        | 0000                    | 3459 568    | Fe        | 2                       |
| 3453 469              | Cr        | 0                       | 3459 714    |           | 0000                    |
| 3453 621              | Co        | 3                       | 3459 761    |           | 0000                    |
| 3453 705              |           | 2                       | 3459 881    | Fe        | 1                       |
| 3453 885              |           | 00                      | 3460 052    | Fe        | 3 d?                    |
| 3453 982              |           | 0000 N                  | 3460 174    | Mn,       | 2                       |
| 3454 303              | Ti        | 1                       | 3460 294    |           | 0000                    |
| 3454 455              |           | 00                      | 3460 460    | Mn,       | 4 d?                    |
| 3454 602              |           | 0000 N                  | 3460 568    | Cr        | 000                     |
| 3454 725              |           | 000 N                   | 3460 691    |           | 0000 N                  |
| 3454 829              |           | 0000 N                  | 3460 741    |           | 0000 N                  |
| 3454 934              |           | 0000 N                  | 3460 874    | Pd        | 00                      |
| 3455 058              |           | 0000                    | 3461 021    |           | 000 N                   |
| 3455 121              | Mn        | 000                     | 3461 111    |           | 00                      |
| 3455 204              | Mn        | 000                     | 3461 321    | Co, La    | 0                       |
| 3455 379 <sup>s</sup> | Co        | 5                       | 3461 413    |           | 0000 N                  |
| 3455 494              |           | 0000 N                  | 3461 633    | Ti        | 5                       |
| 3455 601              |           | 0000 N                  | 3461 801    | Ni        | 8                       |

| Wave length  | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|--------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3461 930     |           | o N                     | 3468 612    |           | o N                     |
| 3462 073     |           | oo N                    | 3468 821    |           | 1                       |
| 3462 217     |           | oooo Nd?                | 3468 986    | Fe        | 2                       |
| 3462 347     |           | ooo                     | 3469 114    |           | o                       |
| 3462 492     | Fe        | 1                       | 3469 155    | Fe        | 2                       |
| 3462 667     |           | oooo Nd?                | 3469 532    |           | o                       |
| 3462 867     |           | oo N                    | 3469 628    | Ni        | 3                       |
| 3462 950     | Co        | 6                       | 3469 736    | Cr        | o                       |
| 3463 153     | Zr        | o                       | 3469 826    |           | oooo N                  |
| 3463 323     |           | oooo N                  | 3469 972    | Fe        | 2                       |
| 3463 444     | Fe        | 1                       | 3470 076    |           | oooo                    |
| 3463 520     |           | oooo                    | 3470 156    |           | oooo                    |
| 3463 660     |           | oooo N                  | 3470 276    |           | oooo N                  |
| 3463 777     |           | oooo Nd?                | 3470 380    |           | ooo N                   |
| 3463 937     |           | oooo Nd?                | 3470 536    |           | oo                      |
| 3464 113     |           | 2                       | 3470 678    |           | o                       |
| 3464 167     |           | oo                      | 3470 776    |           | oooo                    |
| 3464 275     | Fe        | 1 d?                    | 3470 876    |           | oo                      |
| 3464 608 s   |           | 1                       | 3471 000    |           | oooo                    |
| 3464 843     |           | ooo                     | 3471 136    |           | oooo                    |
| 3464 970     |           | oooo                    | 3471 256    |           | ooo                     |
| 3465 052     | Fe        | o                       | 3471 404    | Fe, Zr    | 3                       |
| 3465 167     |           | oooo                    | 3471 499    | Fe, Co    | 3                       |
| 3465 300     |           | oooo                    | 3471 598    |           | o                       |
| 3465 390     | Cr        | oo                      | 3471 750    |           | ooo                     |
| 3465 467     |           | oooo N                  | 3471 856    |           | ooo                     |
| 3465 573     |           | oooo N                  | 3471 910    |           | oooo                    |
| 3465 687     |           | 1                       | 3472 035    |           | 1 N                     |
| 3465 779     |           | 1                       | 3472 190    |           | oo N                    |
| 3465 900 } s | Co        | 4                       | 3472 316    |           | o N                     |
| 3466 015 }   | Fe        | 6                       | 3472 443    |           | oo N                    |
| 3466 137     |           | oo N                    | 3472 593    |           | o                       |
| 3466 187     |           | oo N                    | 3472 680    | Ni        | { 5                     |
| 3466 320     |           | oo                      | 3472 730    |           | { 2                     |
| 3466 420     |           | o                       | 3472 850    |           | oooo N                  |
| 3466 507     |           | oooo N                  | 3472 916    |           | ooo                     |
| 3466 639     | Fe        | 3                       | 3473 040    |           | ooo                     |
| 3466 773     |           | o                       | 3473 146    |           | ooo                     |
| 3466 853     |           | oooo                    | 3473 190    |           | oooo                    |
| 3467 033     | Fe        | 2                       | 3473 363    |           | oooo                    |
| 3467 153     |           | ooo N                   | 3473 435    | Fe        | 2                       |
| 3467 270     |           | ooo N                   | 3473 637    | Fe        | 1                       |
| 3467 407     | Ti        | oo                      | 3473 756    |           | o                       |
| 3467 517     |           | oooo N                  | 3473 823    | Fe        | 1                       |
| 3467 644     | Ni        | 3                       | 3473 950    |           | oooo                    |
| 3467 845     | Ni, Cr    | 2                       | 3474 106    | Co        | 2                       |
| 3468 007     |           | ooo                     | 3474 197    | Mn        | 2                       |
| 3468 210     |           | oo                      | 3474 287    | Mn        | 2                       |
| 3468 347     |           | oooo N                  | 3474 410    |           | oooo                    |
| 3468 486     |           | oooo N                  | 3474 523    |           | oooo                    |

| Wave length | Substance | Intensity and Character | Wave-length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3474 576    | Fe        | 2                       | 3480 549    |           | 000                     |
| 3474 669    |           | 00                      | 3480 669    | Ti        | 1                       |
| 3474 800    |           | 000                     | 3480 785    |           | 0000 N                  |
| 3474 904    |           | 1                       | 3480 875    |           | 0000 N                  |
| 3475 023    |           | 00                      | 3481 024    | Ti        | 2                       |
| 3475 143    |           | 0000 N                  | 3481 195    |           | 00 N                    |
| 3475 270    |           | 2                       | 3481 302    | Pd, Ti Zr | 2                       |
| 3475 406    |           | 0                       | 3481 439    | Cr        | 0                       |
| 3475 456    |           | 00                      | 3481 589    |           | 0000                    |
| 3475 594 s  | Fe        | 10                      | 3481 695    | Fe, Cr    | 2                       |
| 3475 656    |           | 0 N                     | 3481 802    |           | 0000                    |
| 3475 802    | Fe        | 2                       | 3481 889    |           | 000                     |
| 3475 894    |           | 1                       | 3481 952    | Fe        | 00                      |
| 3476 010    | Fe        | 2                       | 3482 075    |           | 000                     |
| 3476 163    |           | 000 N                   | 3482 195    |           | 000                     |
| 3476 330    |           | 0000 N                  | 3482 325    | Fe        | 1                       |
| 3476 479    | Co, Fe    | 3                       | 3482 589    |           | 000                     |
| 3476 590    |           | 0000                    | 3482 712    |           | 000 Nd?                 |
| 3476 756    |           | 0                       | 3482 855    | Zr        | 00                      |
| 3476 849 s  | Fe        | 8                       | 3483 047    | Mn        | 5 d?                    |
| 3477 002    | Fe        | 1                       | 3483 155    | Fe        | 4                       |
| 3477 125    | Fe, Ti    | 3 d?                    | 3483 295    |           | 0000                    |
| 3477 323    | Ti        | 5                       | 3483 553    | Co        | 3                       |
| 3477 500    |           | 000                     | 3483 667    | Fe, Zr    | 0                       |
| 3477 636    |           | 00                      | 3483 769    |           | 000                     |
| 3477 770    |           | 0                       | 3483 923    | Ni        | 6 d?                    |
| 3477 856    |           | 0000                    | 3484 023    |           | 1                       |
| 3478 002 s  | Fe, Ni    | 4                       | 3484 172    |           | 0000 N                  |
| 3478 123    |           | 000                     | 3484 295    |           | 3                       |
| 3478 256    |           | 0000 N                  | 3484 352    |           | 00                      |
| 3478 316    |           | 0000 N                  | 3484 482    |           | 000 Nd?                 |
| 3478 438    | Ni, Zr    | 0                       | 3484 692    |           | 0000 Nd?                |
| 3478 504    | Fe        | 0                       | 3484 809    |           | 0000 N                  |
| 3478 689    | Co, Zr    | 0                       | 3484 922    |           | 00                      |
| 3478 772    | Fe        | 1                       | 3484 995    | Fe        | 1                       |
| 3478 876    |           | 0000                    | 3485 121    | Fe        | 2                       |
| 3478 923    | Co        | 0                       | 3485 249    |           | 1                       |
| 3479 053    |           | 000                     | 3485 369    |           | 0000 N                  |
| 3479 163    | Zr        | 0                       | 3485 493    | Fe Co     | 6                       |
| 3479 273    |           | 0000                    | 3485 645    |           | 0000 N                  |
| 3479 401    | Ni        | 1                       | 3485 719    |           | 0000 N                  |
| 3479 531    | Zr        | 2                       | 3485 845    |           | 00 N                    |
| 3479 703    |           | 0000 N                  | 3486 041 s  | Ni        | 5                       |
| 3479 829    | Fe        | 1                       | 3486 179    |           | 0000                    |
| 3479 969    |           | 0                       | 3486 282    |           | 0000                    |
| 3480 061    |           | 1                       | 3486 362    |           | 000                     |
| 3480 171    |           | 00                      | 3486 475    |           | 000                     |
| 3480 315    | Ni        | 1                       | 3486 522    |           | 0000                    |
| 3480 442    |           | 0000                    | 3486 691    | Fe        | 2                       |
| 3480 476    | Fe, Zr    | 2                       | 3486 782    |           | 0000                    |

| Wave length | Substance | Intensity and Character | Wave length | Substance      | Intensity and Character |
|-------------|-----------|-------------------------|-------------|----------------|-------------------------|
| 3486 889    |           | 0000                    | 3493 313    |                | 0 N                     |
| 3486 962    |           | 0000                    | 3493 430    | Ti, Fe         | 1                       |
| 3487 095    | Mn        | 00 N                    | 3493 618    |                | 2                       |
| 3487 145    |           | 0000                    | 3493 721    |                | 00                      |
| 3487 289    |           | 0000                    | 3493 834    | Fe             | 1                       |
| 3487 415    |           | 0000                    | 3494 004    |                | 00                      |
| 3487 542    |           | 000                     | 3494 154    |                | 0000 N                  |
| 3487 743    |           | 2                       | 3494 308    | Fe             | 2                       |
| 3487 857    | Co, Ca    | 0                       | 3494 401    |                | 0000                    |
| 3487 959    |           | 000                     | 3494 498    |                | 0000                    |
| 3488 131    |           | 2                       | 3494 551    |                | 0000                    |
| 3488 289    |           | 0000 Nd?                | 3494 654    |                | 0                       |
| 3488 437    | Ni, Mn    | 0                       | 3494 815    | Fe             | 2                       |
| 3488 589    |           | 000                     | 3494 871    |                | 000                     |
| 3488 702    |           | 0000 N                  | 3494 994    |                | 0000 N                  |
| 3488 817    | Mn        | 4                       | 3495 108    | Cr             | 00                      |
| 3488 965    |           | 1                       | 3495 178    |                | 0000 N                  |
| 3489 142    |           | 00 Nd?                  | 3495 384    |                | 0                       |
| 3489 302    |           | 00 N                    | 3495 423    | Fe             | 3                       |
| 3489 392    |           | 0000 N                  | 3495 522    |                | 2                       |
| 3489 546    | Co        | 5                       | 3495 658    |                | 000                     |
| 3489 813    | Fe        | 3                       | 3495 802    | Co             | 3                       |
| 3489 889    | Ti, Pd    | 2                       | 3495 853    | I <sub>1</sub> | 2                       |
| 3490 048    |           | 0000                    | 3495 974    | Mn             | 2                       |
| 3490 104    |           | 0000                    | 3496 024    | Fe             | 2                       |
| 3490 191    |           | 0000                    | 3496 101    |                | 0000                    |
| 3490 301    |           | 0                       | 3496 224    | Co             | 0                       |
| 3490 341    |           | 0000                    | 3496 348    | Zi             | 2                       |
| 3490 441    |           | 0000                    | 3496 491    | Ni             | 0                       |
| 3490 534    |           | 00                      | 3496 614    |                | 0000 N                  |
| 3490 628    |           | 0                       | 3496 721    |                | 0                       |
| 3490 733 s  | Fe        | 10 N                    | 3496 820    | Co             | 3                       |
| 3490 896    | Co        | 0                       | 3496 952    | Co, Mn         | 3                       |
| 3491 008    |           | 000 Nd?                 | 3497 148    |                | 1                       |
| 3491 195    | Ti        | 5                       | 3497 241    | Fe             | 3                       |
| 3491 354    |           | 000                     | 3497 301    |                | 2                       |
| 3491 462 s  | Co,       | 4                       | 3497 421    |                | 0000 N                  |
| 3491 661    |           | 0000 N                  | 3497 534    |                | 0                       |
| 3491 894    |           | 000                     | 3497 668    | Mn             | 3                       |
| 3492 021    |           | 0000 N                  | 3497 874    |                | 0 N                     |
| 3492 112    | Co        | 00                      | 3497 982 s  | Fe             | 8                       |
| 3492 174    |           | 0000                    | 3498 116    |                | 0                       |
| 3492 284    |           | 0000                    | 3498 322    |                | 1 N                     |
| 3492 368    |           | 000 N                   | 3498 451    |                | 0000 N                  |
| 3492 508    |           | 00 N                    | 3498 534    |                | 0000 N                  |
| 3492 678    |           | 000 N                   | 3498 668    |                | 00                      |
| 3492 858    |           | 000 N                   | 3498 888    |                | 1                       |
| 3492 954    |           | 00 N                    | 3499 084    |                | 00                      |
| 3493 114    | Ni        | 10 N                    | 3499 248    | Ti             | 0                       |
| 3493 228    |           | 000 N                   | 3499 408    |                | 00                      |

| Wave length | Substance | Intensity and Character | Wave length | Substance      | Intensity and Character |
|-------------|-----------|-------------------------|-------------|----------------|-------------------------|
| 3499 492    |           | 0                       | 3505 371    |                | 0000                    |
| 3499 608    |           | 0000 N                  | 3505 433    |                | 0                       |
| 3499 711    |           | 0                       | 3505 525    |                | 0000                    |
| 3499 848    |           | 0000 Nd?                | 3505 628    | Z <sub>1</sub> | 0                       |
| 3499 974    |           | 0000                    | 3505 810    | /r V           | I                       |
| 3500 013    |           | 0                       | 3505 928    |                | 0000                    |
| 3500 131    |           | 000                     | 3506 038    |                | 0                       |
| 3500 296    |           | 0                       | 3506 189    |                | 000                     |
| 3500 474    | Ti        | 3                       | 3506 380    | Fe             | I                       |
| 3500 577    |           | 0000                    | 3506 467    | Co             | 5                       |
| 3500 706 s  | Fe        | 2                       | 3506 645    | Fe             | 3                       |
| 3500 830    |           | 0000 N                  | 3506 733    | li             | I                       |
| 3500 996 s  | Ni        | 6 d?                    | 3506 793    |                | 0000                    |
| 3501 094    |           | 0000                    | 3506 891    |                | 0000                    |
| 3501 210    |           | 0000                    | 3506 980    |                | 0                       |
| 3501 296    |           | 0000                    | 3507 077    |                | 0000                    |
| 3501 394    |           | 0000                    | 3507 284    |                | 2                       |
| 3501 472    |           | 000                     | 3507 350    |                | 0                       |
| 3501 605    |           | 000 N                   | 3507 447    |                | 0000                    |
| 3501 710    |           | 0000 N                  | 3507 543    | Fe             | I                       |
| 3501 841    |           | 0                       | 3507 687    |                | 0000 N                  |
| 3501 868    |           | 0                       | 3507 837    | Ni             | 3                       |
| 3501 970    |           | 000 N                   | 3507 957    |                | 000                     |
| 3502 104    |           | 000 N                   | 3508 090    |                | 00                      |
| 3502 165    |           | 0000                    | 3508 234    |                | 000                     |
| 3502 394    |           | { 3                     | 3508 350    |                | I                       |
| 3502 466    | Co        | { 3                     | 3508 487    |                | 0000 N                  |
| 3502 608    |           | 00                      | 3508 626    | Fe             | 3                       |
| 3502 737    | Ni        | 2                       | 3508 670    | Fe             | 2                       |
| 3502 775    | Co        | 2                       | 3508 847    |                | 0000 N                  |
| 3502 899    |           | 0000                    | 3509 037    |                | 00                      |
| 3503 001    |           | 00                      | 3509 157    |                | 0000                    |
| 3503 112    |           | 0000                    | 3509 264    | Fe             | 2                       |
| 3503 256    |           | 000 N                   | 3509 470    |                | 0000                    |
| 3503 442    |           | 000 N                   | 3509 570    |                | 0000                    |
| 3503 612    |           | I                       | 3509 690    |                | 0000                    |
| 3503 699    |           | 0000                    | 3509 870    |                | I                       |
| 3503 866    | Co        | 00 Nt?                  | 3509 992    | Co, Fe         | 4                       |
| 3504 048    |           | 00                      | 3510 209    |                | 000                     |
| 3504 192    |           | 0000                    | 3510 331    |                | I                       |
| 3504 332    |           | 0000                    | 3510 466    | Ni             | 8                       |
| 3504 399    |           | 0000                    | 3510 596    | Co, Fe         | 2                       |
| 3504 581    | Fe, V     | 2                       | 3510 693    |                | 00                      |
| 3504 733    |           | 0000                    | 3510 824    |                | I                       |
| 3504 823    |           | I                       | 3510 985 s  | Ti             | 5                       |
| 3504 885    | Co        | 0000                    | 3511 209    |                | 0000 Nd?                |
| 3505 015    | Fe        | 3                       | 3511 356    |                | 0000                    |
| 3505 056    | Ti        | 2                       | 3511 453    |                | 0000                    |
| 3505 202    | Fe        | 3                       | 3511 583    |                | 0000                    |
| 3505 288    | Co        | 0000                    | 3511 676    |                | 0000                    |

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3511 763    | Mn        | 0                       | 3518 790    | Ni        | 4                       |
| 3511 883    | Fe        | 1                       | 3518 825    | Fe        | 3                       |
| 3511 978    | Mn        | 2                       | 3518 933    |           | 0000                    |
| 3512 066    |           | 00                      | 3519 014    | Ti, Fe    | 3                       |
| 3512 228    | Fe        | 1                       | 3519 239    | Ti?       | 0000Nd†                 |
| 3512 369    | Fe        | 2                       | 3519 531    |           | 0000                    |
| 3512 520    |           | 000                     | 3519 645    |           | 0000                    |
| 3512 639    |           | 0000                    | 3519 758    |           | 0000                    |
| 3512 785    | Co        | 6                       | 3519 904    | Ni        | 7                       |
| 3512 869    |           | 00                      | 3520 021    |           | 0000                    |
| 3512 950    |           | 00                      | 3520 168    |           | 2                       |
| 3513 100    | Fe        | 1                       | 3520 228    | Co        | 3                       |
| 3513 200    | Fe        | 2                       | 3520 397    | Ti        | 2                       |
| 3513 422    |           | 0000 N                  | 3520 531    |           | 0000                    |
| 3513 623    | Co        | 5                       | 3520 675    | Fe        | 000                     |
| 3513 744    |           | 000                     | 3520 751    |           | 0000                    |
| 3513 868    |           | 00                      | 3520 871    |           | 0000                    |
| 3513 965 s  | Fe        | 7                       | 3520 991    | Fe, Zr    | 2                       |
| 3514 082    |           | 4                       | 3521 118    |           | 0000                    |
| 3514 138    | Ni        | 3                       | 3521 205    |           | 0                       |
| 3514 382    |           | 0000 N                  | 3521 318    |           | 00                      |
| 3514 608    |           | 0                       | 3521 410 s  | Fe        | 8                       |
| 3514 775    | Fe        | 2                       | 3521 686    |           | 3                       |
| 3515 206    | Ni        | 12                      | 3521 748    | Co        | 4                       |
| 3515 549    |           | 0                       | 3521 888    |           | 000                     |
| 3515 675    |           | 00                      | 3521 984    | Fe        | 2                       |
| 3515 787    |           | 0000                    | 3522 184    |           | 0000                    |
| 3515 947    |           | 0000 N                  | 3522 284    |           | 0000                    |
| 3516 021    |           | 0000 N                  | 3522 412    | Fe        | 4                       |
| 3516 156    |           | 000                     | 3522 589    |           | 00                      |
| 3516 261    |           | 0000                    | 3522 677    |           | 0000                    |
| 3516 359    | Ni        | 2                       | 3522 757    |           | 0000                    |
| 3516 441    |           | 0000                    | 3522 877    |           | 000                     |
| 3516 554    | Fe, Co    | 2                       | 3522 974    |           | 000                     |
| 3516 701    | Fe        | 2                       | 3523 048    | Fe, Co,   | 2                       |
| 3516 854    |           | 0000                    | 3523 212    | Ni        | 1                       |
| 3516 959    |           | 0                       | 3523 324    |           | 0                       |
| 3517 093    | Pd        | 00                      | 3523 452    | Fe        | 2                       |
| 3517 173    |           | 0000                    | 3523 584    | Co        | 4                       |
| 3517 310    |           | 0000 N                  | 3523 700    |           | 000                     |
| 3517 446    | -, V      | 3                       | 3523 850    | Co        | 0                       |
| 3517 523    |           | 0000                    | 3523 924    |           | 0000                    |
| 3517 653    |           | 000 N                   | 3524 130    |           | 000                     |
| 3517 860    |           | 0000 N                  | 3524 221    | Fe        | 3                       |
| 3517 960    |           | 0000 N                  | 3524 385    | Fe        | 3                       |
| 3518 103    |           | 0000                    | 3524 499    |           | 0                       |
| 3518 200    |           | 0000                    | 3524 677    | Ni        | 20                      |
| 3518 360    |           | 0000                    | 3524 883    |           | 1                       |
| 3518 488 s  | Co        | 5                       | 3525 063    |           | 000 N                   |
| 3518 636    |           | 0000                    | 3525 271    |           | 000 N                   |

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3525 416    |           | 0000                    | 3532 143    | Mn        | 4                       |
| 3525 529    |           | 0000                    | 3532 262    | Mn        | 3                       |
| 3525 656    |           | 0000                    | 3532 469    |           | 000                     |
| 3525 759    |           | 2                       | 3532 601    |           | 0000                    |
| 3525 986    | Fe        | 4                       | 3532 721    | Fe,       | 4                       |
| 3526 103    |           | 00                      | 3532 777    |           | 00                      |
| 3526 183    | Fe        | 6                       | 3533 041    |           | 0000                    |
| 3526 311    |           | 3                       | 3533 156    | Fe        | 6                       |
| 3526 398    | Fe        | 2                       | 3533 345    | Fe        | 6                       |
| 3526 526    | Fe        | 2                       | 3533 506    | Co        | 5                       |
| 3526 625    |           | 2                       | 3533 680    |           | 0000                    |
| 3526 686    |           | 0                       | 3533 836    | V         | 000                     |
| 3526 821    | Fe        | 4                       | 3534 000    | Ti        | 1                       |
| 3526 988    | Co        | 6                       | 3534 206    |           | 0000                    |
| 3527 115    |           | 0                       | 3534 400    |           | 000                     |
| 3527 252    |           | 00                      | 3534 672    | Fe        | 2                       |
| 3527 368    |           | 0000                    | 3534 733    |           | 0000                    |
| 3527 458    |           | 000                     | 3534 830    |           | 0000                    |
| 3527 588    |           | 0000                    | 3534 920    | Co        | 000                     |
| 3527 672    |           | 000                     | 3535 060    | Fe        | 3                       |
| 3527 750    |           | 1                       | 3535 090    |           | 00                      |
| 3527 936    | Fe        | 5                       | 3535 180    |           | 0000N                   |
| 3528 041    |           | 0                       | 3535 300    |           | 0000N                   |
| 3528 133    | Ni        | 4                       | 3535 446    | C         | 000                     |
| 3528 382    |           | 0                       | 3535 554    | Li        | 4                       |
| 3528 465    |           | 00                      | 3535 660    |           | 0000                    |
| 3528 552    |           | 0000                    | 3535 766    | C         | 000                     |
| 3528 715    |           | 0000N                   | 3535 868    |           | 3                       |
| 3528 928    |           | 0000                    | 3535 989    |           | 0000                    |
| 3529 035    | Ni        | 1                       | 3536 165    |           | 00                      |
| 3529 181    | Co        | 3                       | 3536 259    |           | 0000                    |
| 3529 328    |           | 00                      | 3536 405    |           | 0000N                   |
| 3529 495    |           | 00                      | 3536 709    | Fe        | 7                       |
| 3529 662    | Fe        | 2                       | 3536 832    |           | 0000                    |
| 3529 768    | Ni        | 1                       | 3536 934    |           | 00                      |
| 3529 872    |           | 00                      | 3537 025    |           | 0000                    |
| 3529 964    | Fe-Co     | 6                       | 3537 105    |           | 00N                     |
| 3530 136    |           | 0000                    | 3537 265    |           | 0000Nd?                 |
| 3530 264    |           | 0000                    | 3537 385    | Ni, C     | 1                       |
| 3530 374    |           | 0000                    | 3537 439    |           | 0000                    |
| 3530 533    | Fe        | 3                       | 3537 638    | Fe        | 2                       |
| 3530 734    | Ni, Li    | 1                       | 3537 772    | Co        | 0                       |
| 3530 919    |           | 3                       | 3537 879    | Fe        | 3                       |
| 3531 107    |           | 00                      | 3538 045    | Fe        | 4                       |
| 3531 247    |           | 0000N                   | 3538 219    |           | 0000N                   |
| 3531 424    |           | 0000N                   | 3538 399    |           | 1                       |
| 3531 582    | Fe        | 2                       | 3538 452    | Fe        | 1                       |
| 3531 761    |           | 0000                    | 3538 555    |           | 0000.                   |
| 3531 851    |           | 1                       | 3538 643    |           | 1                       |
| 3531 982    | Mn        | 3                       | 3538 701    | Fe        | 2                       |



# TABLE OF SOLAR SPECTRUM WAVE-LENGTHS

51

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3538 832    |           | 0000                    | 3544 888    |           | 0000                    |
| 3538 937    | Fe        | 1                       | 3545 001    |           | 0000                    |
| 3539 081    | C         | 00                      | 3545 054    | C         | 000                     |
| 3539 218    | C         | 00                      | 3545 128    | C         | 000                     |
| 3539 391    |           | 0000                    | 3545 194    |           | 0000                    |
| 3539 513    |           | 0000                    | 3545 336 s  | -, V      | 4                       |
| 3539 588    |           | 000                     | 3545 481    |           | 0000 N                  |
| 3539 684    |           | 0000                    | 3545 654    | C         | 0                       |
| 3539 771    |           | 0000                    | 3545 786    | Fe, C     | 5                       |
| 3539 892    |           | 00                      | 3545 971    | Fe, C     | 3                       |
| 3540 038    | C         | 00 N                    | 3546 048    |           | 0000                    |
| 3540 098    |           | 0000                    | 3546 161    |           | 0000                    |
| 3540 268 s  | Fe        | 5                       | 3546 348    |           | 1                       |
| 3540 464    | C         | 000                     | 3546 488    |           | 0000                    |
| 3540 538    |           | 000                     | 3546 568    |           | 0000                    |
| 3540 644    |           | 0000 N                  | 3546 684    |           | 00                      |
| 3540 857    | Fe        | 3                       | 3546 851    | Co        | 00                      |
| 3540 950    | Fe        | 2                       | 3546 921    |           | 000                     |
| 3541 108    |           | 00 N                    | 3546 974    |           | 000                     |
| 3541 237    | Fe        | 7                       | 3547 121    |           | 0000                    |
| 3541 384    |           | 00 N                    | 3547 168    | Tl        | 0                       |
| 3541 474    |           | 000                     | 3547 320    |           | 3                       |
| 3541 687    | C         | 000                     | 3547 362    | Fe        | 3                       |
| 3541 790    |           | 0000                    | 3547 511    |           | 0000Nd?                 |
| 3542 017    | C         | 000                     | 3547 640    |           | 0000                    |
| 3542 129    | Ni        | 0                       | 3547 780    |           | 000 N                   |
| 3542 232    | Fe        | 6                       | 3547 941    | Mn        | 5                       |
| 3542 397    | Fe        | 3                       | 3548 087    |           | 00                      |
| 3542 473    |           | 0000                    | 3548 175    | Mn, Fe    | 3                       |
| 3542 583    |           | 0000                    | 3548 332    | Mn, Ni    | 5                       |
| 3542 633    |           | 0000                    | 3548 447    |           | 0000                    |
| 3542 713    | Li        | 00                      | 3548 593    | Co        | 00                      |
| 3542 775    | Zr        | 00                      | 3548 687    |           | 000                     |
| 3542 910    |           | 0000 N                  | 3548 793    |           | 0000                    |
| 3543 090    |           | 0000                    | 3548 880    |           | 0000                    |
| 3543 143    |           | 0000                    | 3549 047    |           | 0000 N                  |
| 3543 243    |           | 0000                    | 3549 151 s  | Y ?       | 2                       |
| 3543 310    |           | 0000                    | 3549 260    |           | 0000                    |
| 3543 407    | Co        | 2                       | 3549 384    |           | 1                       |
| 3543 531    | Fe        | 2                       | 3549 513    | C         | 0                       |
| 3543 637    |           | 0000                    | 3549 667    | C         | 00                      |
| 3543 824    | Fe        | 3                       | 3549 773    |           | 0000                    |
| 3543 937    |           | 0000                    | 3549 907    |           | 0000Nd?                 |
| 3544 075    | C         | 0000                    | 3550 014 s  | Fe        | 3                       |
| 3544 155    | C         | 000                     | 3550 247    |           | 0000                    |
| 3544 229    |           | 0000                    | 3550 363    | C         | 1 N                     |
| 3544 371    |           | 1                       | 3550 510    |           | 000                     |
| 3544 489    |           | 0000                    | 3550 627    | C         | 0000                    |
| 3544 662    |           | 000                     | 3550 740    | Co        | 4                       |
| 3544 776    | Fe        | 3                       | 3550 939    | C         | 000 Nd?                 |

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3551 092    | C         | 0000 N                  | 3557 036    |           | 3                       |
| 3551 253    |           | I                       | 3557 204    |           | 0000                    |
| 3551 370    | C         | 000                     | 3557 304    |           | 000                     |
| 3551 542    |           | 000                     | 3557 370    |           | 000                     |
| 3551 674    | Ni        | 4                       | 3557 495    |           | 00                      |
| 3551 800    |           | I                       | 3557 604    |           | 0000                    |
| 3551 912    |           | 0000                    | 3557 817    |           | 0000                    |
| 3552 012    |           | 0000                    | 3557 907    |           | 0000                    |
| 3552 098    | Zr        | I                       | 3558 020    |           | 0000 N                  |
| 3552 253    | Fe        | 2                       | 3558 140    |           | 0000                    |
| 3552 449    |           | 0000 N                  | 3558 214    |           | I                       |
| 3552 574    |           | 0                       | 3558 350    |           | 000                     |
| 3552 699    |           | 0000                    | 3558 477    |           | 00 N                    |
| 3552 866    | Co        | I                       | 3558 570    |           | 0 N                     |
| 3552 986    | Fe        | 5                       | 3558 672 s  | Fe        | 8                       |
| 3553 086    |           | 000                     | 3558 774    |           | 0 N                     |
| 3553 132    | Co        | I                       | 3558 923    | Co        | I                       |
| 3553 236    |           | 000                     | 3559 017    |           | 0000                    |
| 3553 304    | Pd        | 00                      | 3559 124    |           | 0000                    |
| 3553 416    |           | 0000                    | 3559 219    | Fe        | I                       |
| 3553 491    |           | 0000                    | 3559 347    |           | 00                      |
| 3553 624    | Ni        | 3                       | 3559 414    |           | 0000                    |
| 3553 735    |           | 0000                    | 3559 604    |           | I                       |
| 3553 887    | Fe        | 5                       | 3559 656    | Fe        | 3                       |
| 3554 011    |           | 000                     | 3559 750    |           | 0000                    |
| 3554 115    |           | 0000                    | 3559 840    |           | 0000                    |
| 3554 203    | Fe        | 5                       | 3559 954    |           | 000                     |
| 3554 418    |           | 000                     | 3560 063    | Ni        | 0                       |
| 3554 438    |           | 0000                    | 3560 216    |           | 00                      |
| 3554 593    |           | 2                       | 3560 303    |           | 000                     |
| 3554 651    | Fe        | 3                       | 3560 436    |           | 000 N                   |
| 3554 789    |           | I                       | 3560 556    |           | 000                     |
| 3554 938    |           | 0 N                     | 3560 649    |           | 0000                    |
| 3555 079    | Fe        | 9                       | 3560 729    |           | I                       |
| 3555 185    |           | 0 N                     | 3560 843    | Fe        | 2                       |
| 3555 318    |           | 000 N                   | 3560 942    |           | 0000                    |
| 3555 425    |           | 0000                    | 3561 037    | Co        | 4                       |
| 3555 498    |           | 0000                    | 3561 203    |           | 0000                    |
| 3555 598    |           | 2                       | 3561 276    |           | 0000                    |
| 3555 758    |           | 0000                    | 3561 419    |           | 0000                    |
| 3555 865    |           | 0000                    | 3561 516    |           | 0000                    |
| 3555 945    |           | 0000                    | 3561 609    |           | 0000                    |
| 3556 088    |           | 000 Nd?                 | 3561 718    | Li        | I                       |
| 3556 291    |           | 000                     | 3561 796    |           | 0000                    |
| 3556 405    |           | 0000                    | 3561 898    | Ni        | 3                       |
| 3556 515    |           | 0000                    | 3562 043    | Fe, Li    | I                       |
| 3556 631    |           | 0000                    | 3562 161    |           | 0000                    |
| 3556 738    | Zr        | 2                       | 3562 236    | Co        | 0 N                     |
| 3556 830    | Fe        | 2                       | 3562 331    |           | 0000                    |
| 3556 944    | Fe        | 4                       | 3562 410    |           | I                       |

# PRELIMINARY TABLE OF SOLAR SPECTRUM WAVE-LENGTHS XVIII

By HENRY A ROWLAND

| Wave length  | Substance      | Intensity and Character | Wave length  | Substance | Intensity and Character |
|--------------|----------------|-------------------------|--------------|-----------|-------------------------|
| 3562 549     |                | 0000                    | 3567 517     | Fe        | 1                       |
| 3562 689     |                | 0000                    | 3567 594     |           | 0000                    |
| 3562 746     |                | 0000                    | 3567 711     |           | 0000                    |
| 3562 848     |                | 0000                    | 3567 835     |           | 4                       |
| 3563 065     | Co             | o N                     | 3567 881     |           | 2                       |
| 3563 152     |                | ooo                     | 3568 083     |           | oo                      |
| 3563 298     |                | ooo N                   | 3568 147     |           | 0000                    |
| 3563 542     |                | ooo N                   | 3568 281     |           | 0000                    |
| 3563 750     |                | oo                      | 3568 387     |           | oo                      |
| 3563 855     |                | 0000                    | 3568 451     |           | 0000                    |
| 3563 928     |                | ooo N                   | 3568 587     | Fe        | 3                       |
| 3564 065     |                | 0000 N                  | 3568 767     |           | oo                      |
| 3564 264     | Fe Co          | 4                       | 3568 968     | Fe        | 3                       |
| 3564 418     |                | 0000                    | 3569 122     | Fe        | 4                       |
| 3564 537     |                | 0000                    | 3569 281     |           | 0000                    |
| 3564 664 } s | T <sub>1</sub> | 3                       | 3569 371     |           | 0000                    |
| 3564 705 } s | Fe             | 2                       | 3569 523     | Co        | 5                       |
| 3564 822     |                | ooo                     | 3569 649     | Mn        | 4                       |
| 3564 935     |                | oo                      | 3569 761     |           | 0000                    |
| 3565 075     | Co             | 4                       | 3569 873     |           | o                       |
| 3565 128     |                | 3                       | 3569 958     | Mn        | 2                       |
| 3565 268     |                | 1 N                     | 3570 060     |           | ooo                     |
| 3565 445     |                | 3 N                     | 3570 183 } s | Mn        | 4                       |
| 3565 535 s   | Fe             | 20                      | 3570 273 } s | Fe        | 20                      |
| 3565 735     |                | 4                       | 3570 415 s   |           | 4                       |
| 3565 855     |                | ooo N                   | 3570 566     |           | 0000                    |
| 3565 977     |                | o                       | 3570 660     |           | o                       |
| 3566 111     | T <sub>1</sub> | 1                       | 3570 736     |           | 0000                    |
| 3566 227     |                | ooo                     | 3570 826     |           | 0000                    |
| 3566 314     |                | 2 N                     | 3571 000     |           | 0000                    |
| 3566 454     | Cr             | o N                     | 3571 126     |           | o                       |
| 3566 522     | Ni             | 10                      | 3571 250     | Pd        | 0000                    |
| 3566 624     |                | o                       | 3571 374     | Fe        | 3                       |
| 3566 728     |                | 1                       | 3571 546     |           | oo                      |
| 3566 807     |                | 0000                    | 3571 690     |           | 0000                    |
| 3566 897     |                | 0000                    | 3571 828     |           | 2                       |
| 3566 984     |                | 0000                    | 3571 913     |           | ooo                     |
| 3567 061     |                | 1                       | 3572 014     | Ni        | 6                       |
| 3567 181     | Fe             | 2                       | 3572 145     | Fe        | 5                       |
| 3567 334     |                | 0000 N                  | 3572 280     |           | oo                      |

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3572 460    |           | 0000                    | 3578 530    | Fe        | 4                       |
| 3572 617    |           | 4                       | 3578 702    |           | 0                       |
| 3572 712    | ,Sc       | 6                       | 3578 832    | Cr        | 10                      |
| 3572 890    | Cr?       | 00                      | 3578 978    |           | 000                     |
| 3573 017    |           | 0000 N                  | 3579 047    | Co        | 0                       |
| 3573 087    |           | 0000 N                  | 3579 122    |           | 00                      |
| 3573 207    | Fe        | 1 N                     | 3579 185    |           | 00                      |
| 3573 320    |           | 0000                    | 3579 268    |           | 0000 N                  |
| 3573 417    |           | 0000                    | 3579 508    |           | 000 N                   |
| 3573 540    | Fe        | 2                       | 3579 648    |           | 0000                    |
| 3573 650    |           | 0000                    | 3579 702    |           | 1                       |
| 3573 792    | Ti        | 2                       | 3579 812    |           | 0000                    |
| 3573 874    | Fe        | 3                       | 3579 974    |           | 2                       |
| 3573 975    | Fe        | 3                       | 3580 098    |           | 000 N                   |
| 3574 050    |           | 2                       | 3580 227    |           | 00                      |
| 3574 135    |           | 0                       | 3580 356    |           | 1 N                     |
| 3574 174    |           | 0                       | 3580 552    |           | 1                       |
| 3574 297    |           | 0000                    | 3580 682    |           | 1 N                     |
| 3574 394    | Ti        | 0                       | 3580 808    |           | 0 N                     |
| 3574 499    |           | 000                     | 3581 067    |           | 5                       |
| 3574 559    | La        | 1                       | 3581 184    |           | 1                       |
| 3574 723    |           | 0000 N                  | 3581 349 s  | Fe        | 30                      |
| 3574 944    | Cr        | 0                       | 3581 531    |           | 1                       |
| 3575 106    | Cr-Co     | 5                       | 3581 617    |           | 0                       |
| 3575 260    | Fe        | 3                       | 3581 805    | Fe        | 2                       |
| 3575 391    | Fe        | 3                       | 3581 957    | Fe        | 2                       |
| 3575 494    | Fe        | 2                       | 3582 081    |           | 1                       |
| 3575 533    | Co        | 2                       | 3582 231    |           | 00                      |
| 3575 699    |           | 000                     | 3582 345    | Fe        | 5                       |
| 3575 904    | Zr        | 00                      | 3582 471    |           | 2                       |
| 3576 118    | Fe        | 4                       | 3582 577    |           | 000                     |
| 3576 296    |           | 0000                    | 3582 711    | Fe        | 2                       |
| 3576 393    |           | 0000                    | 3582 838    | Fe        | 3                       |
| 3576 469    |           | 4                       | 3582 884    |           | 00                      |
| 3576 527    | ,Sc?      | 3                       | 3583 017    |           | 0000                    |
| 3576 739    |           | 0000                    | 3583 104    |           | 000                     |
| 3576 906    | Fe        | 2                       | 3583 244    |           | 0000                    |
| 3577 003    | Zr        | 1                       | 3583 357    |           | 000                     |
| 3577 099    |           | 0000                    | 3583 481 s  | Fe        | 5                       |
| 3577 203    |           | 000                     | 3583 581    |           | 0000                    |
| 3577 299    |           | 000                     | 3583 637    |           | 0000                    |
| 3577 384    | Co        | 1                       | 3583 737    |           | 0000                    |
| 3577 532    |           | 000                     | 3583 837    | ,C        | 3                       |
| 3577 605    |           | 1                       | 3584 051    | ,C        | 3                       |
| 3577 705    |           | 0000                    | 3584 147    |           | 0000                    |
| 3577 885    |           | 0000                    | 3584 237    |           | 0000                    |
| 3578 014    | Mn        | 5                       | 3584 397    |           | 0000                    |
| 3578 138    |           | 0000                    | 3584 457    |           | 000                     |
| 3578 240    | Co        | 1                       | 3584 523    |           | 0000                    |
| 3578 358    | Ti        | 00                      | 3584 616    |           | 0000                    |

| Wave length             | Substance | Intensity and Character | Wave-length | Substance | Intensity and Character |
|-------------------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3584 660 s              | Y         | 2                       | 3590 803    | Fe        | 00                      |
| 3584 800                | Fe        | 6                       | 3590 976    |           | 0000 N                  |
| 3584 940                | Co        | 5                       | 3591 149    | Fe        | 1                       |
| 3585 105                | Fe        | 6                       | 3591 283    |           | 0000                    |
| 3585 214                |           | 000                     | 3591 366    |           | 0000                    |
| 3585 310                | Co        | 5                       | 3591 496    | Fe        | 2                       |
| 3585 479                | Fe        | 7                       | 3591 629    | Fe        | 2                       |
| 3585 658                |           | 2                       | 3591 732    |           | 0000                    |
| 3585 777                |           | 000 N                   | 3591 885    |           | 0000 N                  |
| 3585 859                | Fe        | 6                       | 3592 045    |           | 0000 N                  |
| 3585 984 s <sup>1</sup> | C         | 0                       | 3592 169    | V?        | 2                       |
| 3586 047 s              | C         | 00                      | 3592 348    |           | 0000                    |
| 3586 157                | Co        | 1                       | 3592 412    |           | 000                     |
| 3586 268                | Fe        | 4                       | 3592 508    |           | 0000                    |
| 3586 390                |           | 000                     | 3592 619    | Fe        | 1                       |
| 3586 494                |           | 00                      | 3592 745    |           | 000                     |
| 3586 624                |           | 0000                    | 3592 819    | Fe        | 3                       |
| 3586 684                | Mn        | 4                       | 3592 935    |           | 0000                    |
| 3586 890                |           | 3                       | 3593 040    | Y         | 0                       |
| 3587 024                |           | 0                       | 3593 158    |           | 0000                    |
| 3587 130                | Fe        | 8                       | 3593 223    |           | 0                       |
| 3587 286                | Ti        | 2                       | 3593 402    |           | 000                     |
| 3587 370                | Co        | 7                       | 3593 481    | Fe        | 3                       |
| 3587 497                |           | 000                     | 3593 636    | Cr        | 9                       |
| 3587 574                | Fe        | 3                       | 3593 835    |           | 000                     |
| 3587 757                | C         | 0000 N                  | 3593 935    |           | 000                     |
| 3587 899                | Fe        | 5                       | 3594 138    |           | 000 N                   |
| 3588 084                | Ni        | 6                       | 3594 245    |           | 000                     |
| 3588 263                | C         | 000                     | 3594 458    |           | 0000                    |
| 3588 387                |           | 0                       | 3594 528    |           | 0000                    |
| 3588 466                | C         | 00                      | 3594 784    | Fe        | 6                       |
| 3588 563                |           | 0000                    | 3595 017    | Co        | 3                       |
| 3588 675                |           | 3                       | 3595 161    |           | 0000                    |
| 3588 763                | Fe        | 4                       | 3595 256    | Mn        | 1                       |
| 3588 916                | C         | 0000                    | 3595 449    | Fe, Ti    | 2                       |
| 3589 065                | Fe, C     | 2                       | 3595 554    |           | 0000                    |
| 3589 253                | Fe        | 4                       | 3595 681    |           | 0000 N                  |
| 3589 363                | C         | 0000                    | 3595 824    |           | 000                     |
| 3589 446                | C         | 000                     | 3596 012    | Fe        | 1                       |
| 3589 601                | Fe        | 2                       | 3596 195    | Ti        | 4                       |
| 3589 773                |           | 5                       | 3596 346    | Fe        | 1                       |
| 3589 908                |           | 5 d?                    | 3596 454    |           | 0000                    |
| 3590 023                | C         | 0000                    | 3596 534    |           | 0000                    |
| 3590 109                | Mn, C     | 00                      | 3596 651    | Co        | 0                       |
| 3590 235                | Fe, C     | 1                       | 3596 787    |           | 0000                    |
| 3590 383                |           | 0000                    | 3596 894    |           | 0000                    |
| 3590 443                |           | 0000                    | 3597 001    |           | 0000                    |
| 3590 509 <sup>2</sup>   | C         | 2 N                     | 3597 189 s  | Fe        | 5 d?                    |
| 3590 609                |           | 2                       | 3597 294    |           | 0000                    |
| 3590 651                |           | 2                       | 3597 394    |           | 0000Nd?                 |

<sup>1</sup> Beginning of second head of carbon band<sup>2</sup> Beginning of first head of carbon band

| Wave length | Substance | Intensity and Character | Wave length  | Substance | Intensity and Character |
|-------------|-----------|-------------------------|--------------|-----------|-------------------------|
| 3597 541    |           | 0000                    | 3603 719     |           | 2                       |
| 3597 654    |           | 0000                    | 3603 762     |           | 2                       |
| 3597 854    | Ni        | 8                       | 3603 832     |           | 2                       |
| 3597 994    | Fe        | 00                      | 3603 922     | Ti        | 3                       |
| 3598 121    |           | 0000                    | 3603 972     | Fe        | 4                       |
| 3598 167    |           | 0000                    | 3604 091     |           | 1                       |
| 3598 324    |           | 0000 N                  | 3604 259     |           | 0000 N                  |
| 3598 414    |           | 1                       | 3604 419     | Ti        | 1                       |
| 3598 611    |           | 0000 N                  | 3604 519     | Fe        | 2                       |
| 3598 754    |           | 0000                    | 3604 605     |           | 0000                    |
| 3598 862    | Ti, Fe    | 1                       | 3604 699     |           | 0000                    |
| 3598 953    |           | 0000                    | 3604 843     |           | 1                       |
| 3599 081    | Fe?       | 2                       | 3604 945     |           | 0000                    |
| 3599 128    | Fe?       | 2                       | 3605 073     |           | 000                     |
| 3599 287    | Fe        | 2                       | 3605 159     |           | 000                     |
| 3599 523    |           | 000 N                   | 3605 222     |           | 00                      |
| 3599 686    |           | 0000                    | 3605 341     | Fe?       | 5                       |
| 3599 774    | Fe        | 3                       | 3605 479 s   | Cr        | 7                       |
| 3599 906    |           | 0000                    | 3605 615     | Fe        | 4                       |
| 3599 973    |           | 0000                    | 3605 669 } s | Fe        | 4                       |
| 3600 112    |           | 1                       | 3605 832     |           | 0000 N                  |
| 3600 313    |           | 0000 N                  | 3606 059     | Fe        | 1                       |
| 3600 513    |           | 0000                    | 3606 179     |           | 000                     |
| 3600 596    |           | 0000 N                  | 3606 272     |           | 0000                    |
| 3600 733    |           | 0000                    | 3606 391     |           | 0000                    |
| 3600 880 s  | Y         | 3                       | 3606 518     |           | 0                       |
| 3600 966    |           | 0000                    | 3606 678     | Fe        | 2                       |
| 3601 060    |           | 0000                    | 3606 751     |           | 1                       |
| 3601 220    |           | 0000 N                  | 3606 838 s   | Fe        | 6                       |
| 3601 340    |           | 000                     | 3606 994     | Ni        | 1                       |
| 3601 426    |           | 0000                    | 3607 144     |           | 0000                    |
| 3601 500    |           | 0000 N                  | 3607 264     |           | 0000                    |
| 3601 570    |           | 000                     | 3607 391     | Zr        | 0000                    |
| 3601 686    |           | 0000                    | 3607 518     |           | 000                     |
| 3601 806    | Cr        | 0                       | 3607 672     | Mn        | 3                       |
| 3601 930    |           | 0000                    | 3607 764     |           | 0000                    |
| 3602 060 s  | Y         | 1                       | 3607 911     |           | 0000 N                  |
| 3602 210    | Co        | 3                       | 3608 004     |           | 000 N                   |
| 3602 253    | Fe        | 2                       | 3608 111     |           | 0000                    |
| 3602 559    | Ni        | 4                       | 3608 149     |           | 2                       |
| 3602 611    | Fe        | 3                       | 3608 291     | Fe        | 4 d?                    |
| 3602.686    | Fe        | 4                       | 3608 458     |           | 000 N                   |
| 3602 739    |           | 0000                    | 3608 551     |           | 000                     |
| 3602 849    |           | 000                     | 3608 630     | Mn        | 3                       |
| 3602 912    |           | 0                       | 3608 728     |           | 00 N                    |
| 3603 019    |           | 0000                    | 3608 778     |           | 000 N                   |
| 3603 112    |           | 0000                    | 3608 871     |           | 1 N                     |
| 3603 238    |           | 1                       | 3609 008 s   | Fe        | 20                      |
| 3603 354    | Fe        | 5                       | 3609 134     |           | 0 N                     |
| 3603 579    |           | 0000                    | 3609 244     |           | 0                       |

| Wave length | Substance | Intensity and Character | Wave length  | Substance | Intensity and Character |
|-------------|-----------|-------------------------|--------------|-----------|-------------------------|
| 3609 467    | Ni        | 5d?                     | 3615 462     |           | 0000                    |
| 3609 611    |           | 2                       | 3615 531     | Co, Mn    | 00                      |
| 3609 697    | Pd        | 00                      | 3615 669     |           | 0000 N                  |
| 3609 853    |           | 0000 N                  | 3615 802     | Fe        | 3                       |
| 3609 907    |           | 000 N                   | 3615 949     |           | 0000                    |
| 3610 017    |           | 0000 N                  | 3616 100     | Fe        | 0                       |
| 3610 195    |           | 0 N                     | 3616 294     |           | 2                       |
| 3610 305    | Fe, Ti    | 5                       | 3616 357     |           | 1                       |
| 3610 435    | Mn        | 2                       | 3616 465     | Fe        | 1                       |
| 3610 599    | Cd?       | 4                       | 3616 569     |           | 0000                    |
| 3610 647    | Ni        | 5                       | 3616 710     | Fe        | 4                       |
| 3610 841    | Fe        | 3                       | 3616 866     |           | 0000 N                  |
| 3610 970    |           | 0000                    | 3617 016     |           | 0000 N                  |
| 3611 083    |           | 0000 N                  | 3617 149     |           | 0                       |
| 3611 189 s  | Y, Mg?    | 2                       | 3617 243     | Fe        | 1                       |
| 3611 323    |           | 1                       | 3617 315     |           | 0000                    |
| 3611 443    |           | 000                     | 3617 457     | Fe        | 3                       |
| 3611 598    | Ni        | 0                       | 3617 575     | Mn        | 2                       |
| 3611 697    |           | 00                      | 3617 677     |           | 000                     |
| 3611 862    | Co,-      | 2                       | 3617 855 } s | Ca?       | 1                       |
| 3612 037    | Zr        | 00                      | 3617 934 }   | Ca?       | 6                       |
| 3612 213 s  | Fe        | 4                       | 3618 098     |           | 2 N                     |
| 3612 383    |           | 0000 N                  | 3618 228     |           | 0000                    |
| 3612 520    |           | 0000 N                  | 3618 325     |           | 000                     |
| 3612 657    |           | 000                     | 3618 441     | Ca?       | 3                       |
| 3612 743    |           | 000                     | 3618 532     | Fe        | 3                       |
| 3612 882    | Ni        | 6d?                     | 3618 661     |           | 00                      |
| 3613 079    | Fe, Cd    | 3                       | 3618 753     |           | 1 N                     |
| 3613 247    |           | 2                       | 3618 919 s   | Fe        | 20                      |
| 3613 314    | Fe        | 1 N                     | 3619 061     |           | 0                       |
| 3613 470    |           | 0000                    | 3619 138     |           | 00 N                    |
| 3613 587    | Ti        | 2                       | 3619 253     |           | 0                       |
| 3613 739    | Ti        | 2                       | 3619 412     | Mn        | 1                       |
| 3613 857    |           | 0                       | 3619 539     | Ni        | 8                       |
| 3613 947    | -, Sc     | 4                       | 3619 675     |           | 0 N                     |
| 3614 019    |           | 3                       | 3619 809     |           | 00                      |
| 3614 090    |           | 0000                    | 3619 915     | Fe        | 2                       |
| 3614 159    |           | 0000                    | 3620 076     |           | 1                       |
| 3614 257    | Fe        | 2                       | 3620 171     |           | 0                       |
| 3614 446    |           | 0000 N                  | 3620 295     |           | 0000                    |
| 3614 549    |           | 0000                    | 3620 387     | Fe        | 2                       |
| 3614 697    | Fe        | 2                       | 3620 578     |           | 0000                    |
| 3614 789    | Zr        | 0000                    | 3620 609     | Fe        | 3                       |
| 3614 856    | Fe        | 2                       | 3620 758     |           | 0000 N                  |
| 3614 922    |           | 2                       | 3620 911     |           | 0000 N                  |
| 3615 029    |           | 00                      | 3621 018     | Fe        | 1                       |
| 3615 142    |           | 0000                    | 3621 110     | Y?        | 00                      |
| 3615 222    |           | 0000                    | 3621 244     |           | 3                       |
| 3615 336    | Fe        | 1                       | 3621 340     |           | 2                       |
|             |           |                         | 3621 400     |           | 0                       |

| Wave length | Substance | Intensity and Character | Wave-length | Substance  | Intensity and Character |
|-------------|-----------|-------------------------|-------------|------------|-------------------------|
| 3621 520    |           | 0000 N                  | 3627 763    |            | 000                     |
| 3621 612 s  | Fe        | 6                       | 3627 855    |            | 00                      |
| 3621 740    |           | 0000                    | 3627 953    | Co         | 4                       |
| 3621 864    | Fe        | 2                       | 3628 099    |            | 0000 N                  |
| 3622 007    |           | 0000 N                  | 3628 238    | Fe         | 2                       |
| 3622 147 s  | Fe        | 6                       | 3628 419    |            | 000 N                   |
| 3622 297    |           | 0                       | 3628 579    |            | 0000 N                  |
| 3622 407    |           | 0000                    | 3628 739    |            | 00                      |
| 3622 577    |           | 0000 N                  | 3628 847 s  | Y, Mg?     | 2                       |
| 3622 694    |           | 0000 N                  | 3628 967    | La         | 2                       |
| 3622 794    |           | 000                     | 3629 019    |            | 0000                    |
| 3622 934    |           | 0000                    | 3629 146    |            | 0000                    |
| 3623 040    |           | 0000                    | 3629 286    |            | 0000Nd?                 |
| 3623 180    |           | 0000                    | 3629 492    |            | 000 N                   |
| 3623 234    |           | 0000                    | 3629 652    |            | 0000 N                  |
| 3623 362 s  | Fe        | 5                       | 3629 877    | Mn         | 1                       |
| 3623 460    |           | 0000                    | 3630 045    | Ni         | 1                       |
| 3623 588 s  | Fe        | 2                       | 3630 164    |            | 1                       |
| 3623 650    |           | 00                      | 3630 252    |            | 0000                    |
| 3623 750    |           | 0000                    | 3630 374    |            | 0                       |
| 3623 925    | Mn, Fe    | 4                       | 3630 492    | Fe         | 4                       |
| 3624 057    |           | 1                       | 3630 618    |            | 0000                    |
| 3624 204    |           | 2                       | 3630 718    |            | 0000                    |
| 3624 258    | Ca        | 3                       | 3630 798    |            | 0000                    |
| 3624 447    | Fe Co     | 3                       | 3630 876    |            | 4                       |
| 3624 600    |           | 0000 N                  | 3630 918    |            | 3                       |
| 3624 707    |           | 0000                    | 3631 124    | Ca         | 2                       |
| 3624 873    | Ni        | 4                       | 3631 244    | Fe         | 3                       |
| 3624 979    | Ti, Fe    | 5                       | 3631 404    | Co         | 1                       |
| 3625 103    | Co        | 1                       | 3631 495    | Ti?        | 0                       |
| 3625 287    | Fe        | 5                       | 3631 605 s  | Fe         | 15                      |
| 3625 389    |           | 0000                    | 3631 725    |            | 0                       |
| 3625 506    |           | 0000 N                  | 3631 850    | Co         | 1                       |
| 3625 641    |           | 1                       | 3631 928    |            | 000 N                   |
| 3625 766    |           | 0000 N                  | 3632 098    |            | 2                       |
| 3625 893    |           | 000                     | 3632 193    | Fe         | 3                       |
| 3625 993    |           | 0000                    | 3632 312    |            | 0                       |
| 3626 073    |           | 0000                    | 3632 438    |            | 00                      |
| 3626 156    |           | 0000                    | 3632 585    |            | 0000                    |
| 3626 249    | Ti        | 0                       | 3632 700    | Fe         | 3                       |
| 3626 327    | Fe        | 1                       | 3632 832    |            | 0000                    |
| 3626 526    |           | 0000 N                  | 3632 979    | Co, Cr, Zr | 1                       |
| 3626 633    |           | 0000 N                  | 3633 123    | Fe         | 4                       |
| 3626 746    |           | 0000                    | 3633 215    |            | 2                       |
| 3626 877    |           | 2                       | 3633 277    | Y          | 2                       |
| 3627 046    |           | 0000 N                  | 3633 447    |            | 0000 N                  |
| 3627 201    | Fe        | 2                       | 3633 651    | Ti         | 00 Nd?                  |
| 3627 309    |           | 000                     | 3633 791    |            | 000                     |
| 3627 499    |           | 000 N                   | 3633 974    | Fe         | 4                       |
| 3627 596    |           | 000 N                   | 3634 031    |            | 1                       |



| Wave length | Substance | Intensity and Character | Wave length | Substance  | Intensity and Character |
|-------------|-----------|-------------------------|-------------|------------|-------------------------|
| 3634 144    |           | 0000 N                  | 3639 588    | Co         | 2                       |
| 3634 337    |           | 3                       | 3639 663    | Pb         | 1                       |
| 3634 417    |           | 000                     | 3639 833    |            | 0000                    |
| 3634 471    | Fe        | 3                       | 3639 943    | Cr         | 2                       |
| 3634 551    |           | 1                       | 3640 123    |            | 0000                    |
| 3634 611    |           | 00                      | 3640 256    |            | 0000 N                  |
| 3634 674    |           | 000                     | 3640 403    |            | 0000                    |
| 3634 757    | Pd        | 0000                    | 3640 535 s  | Cr Fe      | 6                       |
| 3634 849    | Fe Co     | 4                       | 3640 783    |            | 000                     |
| 3635 004    |           | 0000                    | 3640 903    |            | 0000                    |
| 3635 091    | Ni        | 3                       | 3641 043    |            | 0000                    |
| 3635 164    |           | 1                       | 3641 170    |            | 1                       |
| 3635 224    |           | 0000                    | 3641 366    |            | 0000 N                  |
| 3635 336    | Ti, Fe    | 2                       | 3641 473    | Ti         | 4                       |
| 3635 419    |           | 000                     | 3641 597    | Mn, Cr     | 1                       |
| 3635 491    |           | 00                      | 3641 784    | Ni         | 1                       |
| 3635 608 s  | Ti, Fe    | 4                       | 3641 930    | Co         | 0                       |
| 3635 791    |           | 000 N                   | 3641 970    | Cr         | 1                       |
| 3635 967    |           | 00                      | 3642 102    | Fe         | 00                      |
| 3636 034    |           | 0000                    | 3642 285    |            | 0000 N                  |
| 3636 184    |           | 0000                    | 3642 419    |            | 000 N                   |
| 3636 305    | Fe        | 3                       | 3642 536    |            | 000                     |
| 3636 377    | Fe        | 2                       | 3642 675    |            | 0000                    |
| 3636 624    |           | 1                       | 3642 820    | Ti         | 7                       |
| 3636 728    | Cr        | 2                       | 3642 912    | Sc         | 2                       |
| 3636 802    | Fe        | 2                       | 3642 965    |            | 3                       |
| 3636 890    | Co        | 2                       | 3643 109    |            | 0000                    |
| 3637 004    |           | 0000                    | 3643 262    | Fe         | 2                       |
| 3637 139    |           | 2                       | 3643 342    | Co         | 1                       |
| 3637 197    | Fe        | 1                       | 3643 492    |            | 0000                    |
| 3637 397    | Fe        | 1                       | 3643 615    |            | 0000                    |
| 3637 456    |           | 0000                    | 3643 764    | Fe         | 4                       |
| 3637 583    |           | 0000                    | 3643 867    | Fe?        | 2                       |
| 3637 693    |           | 00                      | 3643 949    |            | 3                       |
| 3637 876    | Fe        | 0                       | 3644 089    |            | 000                     |
| 3638 011    | Fe        | 4                       | 3644 212    |            | 0000 N                  |
| 3638 113    |           | 000                     | 3644 289    |            | 0000 N                  |
| 3638 196    |           | 0000                    | 3644 455    |            | 0000 N                  |
| 3638 242    |           | 1                       | 3644 555    | Ti, Ca     | 5                       |
| 3638 306    |           | 1                       | 3644 729    |            | 0                       |
| 3638 383    |           | 1                       | 3644 833    | Ti, Fe     | 1                       |
| 3638 442 s  | Fe        | 3                       | 3644 932    | Fe         | 3                       |
| 3638 610    |           | 0000                    | 3645 117    |            | 0                       |
| 3638 743    |           | 0000                    | 3645 221    | Fe         | 2                       |
| 3638 910    |           | 0000                    | 3645 325    |            | 0000                    |
| 3639 043    |           | 000                     | 3645 429    |            | 3                       |
| 3639 168    | V         | 0                       | 3645 475    | Sc?,<br>La | 3                       |
| 3639 270    |           | 0000                    | 3645 552    |            | 00                      |
| 3639 423    |           | 1                       | 3645 636    | Fe         | 3                       |
| 3639 470    |           | 0000                    | 3645 765    |            | 0000                    |

| Wave length | Substance | Intensity and Character | Wave length | Substance  | Intensity and Character |
|-------------|-----------|-------------------------|-------------|------------|-------------------------|
| 3645 967    | Fe        | 4                       | 3652 691 s  | Co         | 3                       |
| 3646 074    |           | 0000                    | 3652 820    |            | 0000Nd?                 |
| 3646 128    |           | 0000                    | 3653 023    |            | 0000                    |
| 3646 236    |           | 00                      | 3653 160    |            | 0000                    |
| 3646 335    | Ti        | 1                       | 3653 260    |            | 0000                    |
| 3646 491    |           | 0000 Nd?                | 3653 340    |            | 0000                    |
| 3646 643    |           | 000                     | 3653 492    |            | 1                       |
| 3646 757    |           | 2                       | 3653 637 s  | Ti         | 5                       |
| 3646 948    |           | 000 N                   | 3653 799    |            | 0000                    |
| 3646 976    |           | 00 N                    | 3653 900    | Fe         | 2                       |
| 3647 128    |           | 2                       | 3654 052    | Cr         | 2                       |
| 3647 234    | Co        | 0                       | 3654 119    | Fe         | 2                       |
| 3647 394    |           | 0000 Nd?                | 3654 266    |            | 0000 N                  |
| 3647 561    | Fe        | 4                       | 3654 392    |            | 0000 N                  |
| 3647 701    |           | 0                       | 3654 526    |            | 0000                    |
| 3647 808    |           | 0                       | 3654 586    | Co         | 00                      |
| 3647 988 s  | Fe        | 12                      | 3654 738    | Ti         | 2                       |
| 3648 221    | Co        | 0 N                     | 3654 813    | Fe         | 1                       |
| 3648 367    |           | 0                       | 3654 999    | Hg?        | 0000                    |
| 3648 461    |           | 00 N                    | 3655 143    | Fe         | 2                       |
| 3648 669    | Cr        | 0                       | 3655 199    |            | 0000                    |
| 3648 778    |           | 0000                    | 3655 359    |            | 00                      |
| 3648 898    |           | 0000                    | 3655 495    |            | 1                       |
| 3648 954    |           | 000                     | 3655 609    | Fe         | 3                       |
| 3649 137    | Cr        | 1                       | 3655 719    |            | 0000                    |
| 3649 234    |           | 0000                    | 3655 801    |            | 3                       |
| 3649 324    |           | 0000                    | 3655 990    |            | 0000                    |
| 3649 438    | Fe        | 4                       | 3656 080    |            | 0000 N                  |
| 3649 476    | Co        | 3                       | 3656 217    |            | 0000                    |
| 3649 654    | Fe, La    | 5                       | 3656 358    | Fe         | 3                       |
| 3649 838    |           | 00                      | 3656 404    | Cl         | 2                       |
| 3649 977    | Co        | 1                       | 3656 496    |            | 1                       |
| 3650 178    | Fe        | 4                       | 3656 687    |            | 000                     |
| 3650 423    | Fe        | 5                       | 3656 844    |            | 0000Nd?                 |
| 3650 507    |           | 0000                    | 3656 997    |            | 0000 N                  |
| 3650 681    |           | 2                       | 3657 104    | Co         | 0                       |
| 3650 860    |           | 0000 N                  | 3657 275    | Fe         | 2                       |
| 3651 027    |           | 0000 N                  | 3657 437    |            | 0000 N                  |
| 3651 179    |           | 00                      | 3657 562    | Fe         | 1                       |
| 3651 247    | Fe,-      | 6                       | 3657 710    |            | 0000 N                  |
| 3651 337    |           | 00                      | 3657 850    | Fe         | 1 N                     |
| 3651 400    |           | 0000                    | 3657 957    |            | 0000                    |
| 3651 493    |           | 0000 N                  | 3658 044    | Co, Fe, Mn | 3                       |
| 3651 614    | Fe        | 7                       | 3658 163    |            | 1                       |
| 3651 794    |           | 1                       | 3658 238    | Ti         | 1                       |
| 3651 940    | , Sc      | 4                       | 3658 306    |            | 0000                    |
| 3652.061    |           | 1                       | 3658 413    |            | 0000 N                  |
| 3652 247    |           | 0000                    | 3658 529    |            | 000 N                   |
| 3652 400    |           | 00                      | 3658 689 s  | Mn-Fe      | 1                       |
| 3652 537    |           | 0000                    | 3658 783    |            | 0000                    |

| Wave length | Substance         | Intensity and Character | Wave length | Substance          | Intensity and Character |
|-------------|-------------------|-------------------------|-------------|--------------------|-------------------------|
| 3659 003    |                   | 0000 N                  | 3664 760    | Y                  | 2                       |
| 3659 109    |                   | 0000 N                  | 3664 838    | Fe                 | 2                       |
| 3659 263    |                   | 0000 N                  | 3664 965    |                    | 000 N                   |
| 3659 373    |                   | 0000 N                  | 3665 082    |                    | 000 N                   |
| 3659 449    |                   | 0000                    | 3665 165    |                    | 00 N                    |
| 3659 663    | Fe                | 5                       | 3665 325    |                    | 0000                    |
| 3659 759    |                   | 0000                    | 3665 441    |                    | 0000                    |
| 3659 901    | Fe T <sub>1</sub> | 5                       | 3665 574    |                    | 0000                    |
| 3660 016    |                   | 0000                    | 3665 731    |                    | 0000                    |
| 3660 109    |                   | 0000 N                  | 3665 861    |                    | 00                      |
| 3660 349    |                   | 00                      | 3665 987    |                    | 0000                    |
| 3660 467    | Fe                | 2                       | 3666 134    | N <sub>1</sub>     | 0                       |
| 3660 549    | Mn                | 1                       | 3666 201    | Fe                 | 1                       |
| 3660 663    |                   | 0000                    | 3666 301    |                    | 0000                    |
| 3660 774    | T <sub>1</sub>    | 2                       | 3666 387    | Fe                 | { 3                     |
| 3660 916    |                   | 2                       | 3666 421    |                    | { 2                     |
| 3661 059    |                   | 0000 N                  | 3666 504    |                    | 0000                    |
| 3661 176    |                   | 000 N                   | 3666 676    |                    | 1                       |
| 3661 289    |                   | 0000                    | 3666 781    | Cr                 | 00                      |
| 3661 396    |                   | 0000                    | 3666 907    | Fe                 | 3                       |
| 3661 506    | Fe                | 3                       | 3666 986    |                    | 000                     |
| 3661 675    |                   | 0000                    | 3667 068    | Fe                 | 3 Nd?                   |
| 3661 775    |                   | 0000                    | 3667 234    |                    | 0000 Nd?                |
| 3661 875    |                   | 0000                    | 3667 397 s  | Fe                 | 4                       |
| 3661 975    |                   | 0000                    | 3667 561    |                    | 0000 N                  |
| 3662 096    | N <sub>1</sub>    | 3                       | 3667 741    |                    | 0000 N                  |
| 3662 195    |                   | 0000                    | 3667 887    |                    | 000                     |
| 3662 308    | Co                | 1                       | 3668 014    |                    | 0000                    |
| 3662 378    | Li                | 5                       | 3668 133    | Fe                 | 4                       |
| 3662 502    |                   | 0000                    | 3668 354    | Fe, N <sub>1</sub> | 3                       |
| 3662 608    |                   | 0000                    | 3668 491    |                    | 0000 N                  |
| 3662 762    |                   | 0000 N                  | 3668 597    | Zr                 | 00                      |
| 3662 875    |                   | 000                     | 3668 634    |                    | 00                      |
| 3662 978    | Fe, Cr            | 4                       | 3668 796    |                    | 00                      |
| 3663 035    |                   | 0000                    | 3668 907    |                    | 0000 N                  |
| 3663 155    |                   | 0000 N                  | 3669 028    | Fe                 | 0                       |
| 3663 208    |                   | 0000 N                  | 3669 106    | T <sub>1</sub>     | 1                       |
| 3663 346    | Cr                | 1                       | 3669 292    | Fe                 | 2                       |
| 3663 402    | Fe                | 3                       | 3669 381    | N <sub>1</sub>     | 4                       |
| 3663 541    |                   | { 3                     | 3669 543    |                    | 00 N                    |
| 3663 596    | Fe                | { 3                     | 3669 666    | Fe                 | 4                       |
| 3663 735    |                   | 0000 N                  | 3669 823    |                    | 1                       |
| 3663 835    |                   | 0000 N                  | 3669 976    | Mn                 | 0000 N                  |
| 3663 968    |                   | 0000 Nd?                | 3670 168    | Co                 | 3                       |
| 3664 104    | Fe                | 2                       | 3670 240    | Fe                 | 2                       |
| 3664 234    | N <sub>1</sub>    | 5 d?                    | 3670 356    |                    | 0000                    |
| 3664 348    |                   | 000                     | 3670 446    |                    | 0000                    |
| 3664 375    |                   | 0000                    | 3670 566    | N <sub>1</sub>     | 5                       |
| 3664 548    |                   | 0000 N                  | 3670 678    | Mn                 | 0 N                     |
| 3664 677    | Fe                | 3                       | 3670 786    |                    | 0000 N                  |

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3670 860    |           | 00 N                    | 3677 231    |           | 0000                    |
| 3670 953    | Fe        | 4                       | 3677 308    |           | 0000                    |
| 3671 046    |           | 0000 N                  | 3677 457    | Fe        | 4                       |
| 3671 226    |           | 0000 N                  | 3677 598    | Fe        | 3                       |
| 3671 358    |           | 000                     | 3677 650    |           | 3                       |
| 3671 412    | Zr        | 0                       | 3677 764    | Fe        | 5                       |
| 3671 506    |           | 0000                    | 3677 831    |           | 3                       |
| 3671 660    | Fe, Pb    | 0                       | 3677 991    |           | 3                       |
| 3671 819    | Ti        | 3                       | 3678 045    |           | 2                       |
| 3671 993    |           | 0000                    | 3678 236    |           | 000 N                   |
| 3672 083    |           | 0000                    | 3678 370    |           | 1 Nd?                   |
| 3672 260    |           | 000                     | 3678 491    |           | 0000                    |
| 3672 452    |           | 0000                    | 3678 591    |           | 0000                    |
| 3672 601    |           | 000                     | 3678 718    |           | 0000                    |
| 3672 742    |           | 0000                    | 3678 864    |           | 0000                    |
| 3672 851    | Fe        | 3                       | 3679 002    | Fe        | 4                       |
| 3672 939    |           | 0000                    | 3679 139    | Fe        | 2                       |
| 3673 049    |           | 0000                    | 3679 248    |           | 000 N                   |
| 3673 182    |           | 0000                    | 3679 488    | Fe        | 1                       |
| 3673 226    | Fe        | 3                       | 3679 575    |           | 0000                    |
| 3673 362    |           | 0 N                     | 3679 675    | Fe        | 1                       |
| 3673 562    |           | 000                     | 3679 821    |           | 2                       |
| 3673 679    |           | 0000                    | 3679 947    |           | 0 N                     |
| 3673 819    |           | 00                      | 3680 069 s  | Fe        | 9                       |
| 3673 909    |           | 0000                    | 3680 137    |           | 0 N                     |
| 3674 025    | Fe        | 2                       | 3680 261    |           | 0 N                     |
| 3674 198    | Fe        | 4                       | 3680 347    |           | 0000 N                  |
| 3674 287    | Ni        | 4                       | 3680 525    |           | 2                       |
| 3674 452    |           | 0000                    | 3680 641    |           | 0000                    |
| 3674 550    | Fe        | 2                       | 3680 801    |           | 3                       |
| 3674 699    |           | 0000                    | 3680 937    | Fe        | 4                       |
| 3674 865    | Zr        | 1                       | 3681 081    |           | 3                       |
| 3674 909    | Fe        | 2                       | 3681 254    |           | 0000                    |
| 3675 059    |           | 0000                    | 3681 368    | Fe        | 2                       |
| 3675 135    |           | 0000                    | 3681 501    |           | 0000                    |
| 3675 255    |           | 0000 N                  | 3681 604    |           | 0000                    |
| 3675 430    |           | 1                       | 3681 787    | Fe        | 3                       |
| 3675 585    |           | 00                      | 3682 021    | Fe        | 0                       |
| 3675 692    |           | 0000                    | 3682 161    | Mn        | 000                     |
| 3675 825    | V         | 1                       | 3682 310    |           | 2                       |
| 3675 902    |           | 0                       | 3682 382    | Fe        | 5                       |
| 3676 018    |           | 0000                    | 3682 661    |           | 00 N                    |
| 3676 112    |           | 000                     | 3682 807    |           | 0 N                     |
| 3676 291    |           | 0000                    | 3683 021    |           | 000 N                   |
| 3676 457    | Fe, Cr    | 6                       | 3683 182    | Co        | 3                       |
| 3676 698    | Co        | 2                       | 3683 229    | Fe V      | 4                       |
| 3676 836    |           | 0000                    | 3683 514    |           | 0000                    |
| 3676 950    |           | 0000                    | 3683 617    | Pb?       | 0000                    |
| 3677 016    | Fe        | 3                       | 3683 761    |           | 2                       |
| 3677 098    |           | 0000                    | 3683 893    |           | 0000                    |

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3684 020    |           | 0000                    | 3690 019    | Fe        | 1                       |
| 3684 106    |           | 0000                    | 3690 053    | Ti        | 2                       |
| 3684 258 s  | Fe        | 7 d?                    | 3690 205    |           | 0000                    |
| 3684 360    |           | 0000                    | 3690 420    | V Pd      | 1                       |
| 3684 460    |           | 0000 N                  | 3690 599    | Fe        | 2                       |
| 3684 600    | Co        | 000 N                   | 3690 732    |           | 0000                    |
| 3684 680    | Mn        | 000 N                   | 3690 870    | Co Fe     | 4                       |
| 3684 858    |           | 0000 N                  | 3690 999    |           | 0000                    |
| 3685 000    |           | 0000 N                  | 3691 112    |           | 0000 N                  |
| 3685 140    |           | 000 N                   | 3691 315    |           | 000 N                   |
| 3685 339    | Ti        | 10 d?                   | 3691 452    | Fe, Mn    | 2                       |
| 3685 665    | Mn, Cr    | 1                       | 3691 534    |           | 0000                    |
| 3685 810    |           | 0000                    | 3691 674    |           | 0000                    |
| 3685 913    |           | 0000                    | 3691 824    |           | 0000                    |
| 3686 026    |           | 0000                    | 3691 954    |           | 0000                    |
| 3686 141    | Ti Fe     | 6                       | 3692 101    |           | 0000                    |
| 3686 246    |           | 0000                    | 3692 251    |           | 0000                    |
| 3686 326    |           | 0000                    | 3692 364    | V         | 1                       |
| 3686 399    | Fe, V     | 3                       | 3692 498    |           | 0000                    |
| 3686 520    |           | 0000                    | 3692 578    |           | 0000                    |
| 3686 611    |           | 0000                    | 3692 708    |           | 0000                    |
| 3686 813    |           | 000                     | 3692 790    | Fe        | 2                       |
| 3686 926    | Cr        | 1                       | 3692 954    | Mn        | 000 N                   |
| 3687 010    |           | 000                     | 3693 024    |           | 0000                    |
| 3687 083    |           | 0000                    | 3693 170    | Fe        | 3                       |
| 3687 234    | Fe        | 3                       | 3693 258    | Co        | 1                       |
| 3687 380    | Cr        | 1                       | 3693 384    |           | 0000                    |
| 3687 473    |           | 1                       | 3693 504    |           | 000                     |
| 3687 610 s  | Fe        | 6                       | 3693 616    | Co        | 1                       |
| 3687 690    | Cr?       | 000                     | 3693 804    | Mn        | 0                       |
| 3687 800    | Fe        | 4                       | 3693 921    |           | 0                       |
| 3687 899    |           | 0000                    | 3694 077    | Ni        | 2                       |
| 3688 005    |           | 0000                    | 3694 164    | Fe        | 4                       |
| 3688 125    |           | 0000                    | 3694 344    |           | 3                       |
| 3688 210    | V         | 1                       | 3694 576    | * La      | 1                       |
| 3688 312    |           | 2                       | 3694 791    |           | 0000                    |
| 3688 425    |           | 0000                    | 3694 954    |           | 000                     |
| 3688 558    | Ni        | 4                       | 3695 041    |           | 0000                    |
| 3688 617    | Fe        | 3                       | 3695 194 s  | Fe        | 5                       |
| 3688 819    |           | 0000                    | 3695 344    |           | 0000 N                  |
| 3688 943    |           | 2                       | 3695 479    | V         | 0                       |
| 3689 013    | Fe        | 1                       | 3695 658    | Fe, Mn    | 1                       |
| 3689 141    |           | 1                       | 3695 789    |           | 2                       |
| 3689 219    | Fe        | 1                       | 3696 006    | Fe, V     | 1                       |
| 3689 345    |           | 0000 N                  | 3696 175    | Fe        | 0                       |
| 3689 459    |           | 000                     | 3696 290    |           | 0000 N                  |
| 3689 513    |           | 3                       | 3696 433    |           | 0                       |
| 3689 614    | Fe        | 6                       | 3696 520    |           | 0                       |
| 3689 769    |           | 0000                    | 3696 660    |           | 000                     |
| 3689 839    |           | 0000                    | 3696 707    | Mn        | 0                       |

| Wave length | Substance      | Intensity and Character | Wave length | Substance        | Intensity and Character |
|-------------|----------------|-------------------------|-------------|------------------|-------------------------|
| 3696 800    | Mn             | 0                       | 3703 242    |                  | 000                     |
| 3696 890    |                | 000                     | 3703 369    |                  | 000 N                   |
| 3696 949    | I <sub>1</sub> | 00                      | 3703 586    |                  | 000                     |
| 3697 047    | Fe, Ni         | 1                       | 3703 683    | Fe-V             | { 4                     |
| 3697 243    |                | 000 N                   | 3703 729    |                  | { 3                     |
| 3697 397    |                | 000 N                   | 3703 834    | Fe               | 3                       |
| 3697 567    | Fe             | 5                       | 3703 962    | Fe               | 2                       |
| 3697 677    |                | 3                       | 3704 176    |                  | { 2                     |
| 3697 883    |                | 000                     | 3704 221    | Co               | { 3                     |
| 3698 007    |                | 000                     | 3704 341    |                  | 000                     |
| 3698 153    |                | 1 N                     | 3704 435    |                  | 00                      |
| 3698 303    | Ti, Zr         | 2                       | 3704 485    | Ti               | 0                       |
| 3698 463    |                | 000 N                   | 3704 603    | Fe               | 4                       |
| 3698 613    |                | 00 N                    | 3704 842    | V                | 1                       |
| 3698 744    | Fe             | 4                       | 3704 935    |                  | 000                     |
| 3698 830    |                | 00                      | 3705 051    |                  | 000                     |
| 3698 940    |                | 000                     | 3705 171    | V                | 0                       |
| 3699 023    |                | 000                     | 3705 251    |                  | 000                     |
| 3699 153    | Co             | 00                      | 3705 401    |                  | 00 N                    |
| 3699 283    | Fe             | 3                       | 3705 561    |                  | 00 N                    |
| 3699 413    |                | 000 N                   | 3705 708 s  | Fe               | 9                       |
| 3699 533    |                | 000                     | 3705 849    |                  | 2                       |
| 3699 710    |                | 000                     | 3705 968    |                  | 000 N                   |
| 3699 877    |                | 000                     | 3706 075    |                  | 00                      |
| 3699 962    |                | 1                       | 3706 175    | Mn- <sup>1</sup> | 6 d?                    |
| 3700 062    |                | 000                     | 3706 363    | Ti               | 3                       |
| 3700 182    | Ti             | 00                      | 3706 475    |                  | 000                     |
| 3700 269    |                | 00                      | 3706 621    |                  | 000                     |
| 3700 406    |                | 000                     | 3706 701    |                  | 000 N                   |
| 3700 479    |                | 1                       | 3706 835    |                  | 000 N                   |
| 3700 596    |                | 000                     | 3707 021    |                  | 000                     |
| 3700 737    |                | 1                       | 3707 186 s  | Fe               | 5                       |
| 3700 876    |                | 000                     | 3707 315    |                  | 000                     |
| 3700 942    |                | 000                     | 3707 468    |                  | 2 N                     |
| 3701 052    |                | 000                     | 3707 600    | Co               | 2                       |
| 3701 132    |                | 000                     | 3707 702    | Ti               | 2                       |
| 3701 234    | Fe             | 8                       | 3707 815    |                  | 000                     |
| 3701 409    |                | 000                     | 3707 959    | Fe?              | 5 d?                    |
| 3701 512    |                | 000                     | 3708 068    | Fe               | 5                       |
| 3701 672    |                | 000                     | 3708 224    |                  | 00                      |
| 3701 749    |                | 000                     | 3708 327    |                  | 000                     |
| 3701 866    | Mn             | 0                       | 3708 454    |                  | 000 N                   |
| 3702 006    |                | 000 Nd?                 | 3708 574    |                  | 000 N                   |
| 3702 170    | Fe             | 4                       | 3708 741    |                  | 1                       |
| 3702 382    | Co             | 2                       | 3708 834    | Ti, V            | 000                     |
| 3702 409    | Ti             | 2                       | 3708 964    | Co               | 1                       |
| 3702 629    | Fe             | 4                       | 3709 170    |                  | 1                       |
| 3702 782    |                | 000 Nd?                 | 3709 290    |                  | 00 N                    |
| 3702 962    |                | 000 Nd?                 | 3709 389 s  | Fe               | 8                       |
| 3703 099    |                | 000 N                   | 3709 540    |                  | 0 N                     |

| Wave length | Substance | Intensity and Character | Wave-length           | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-----------------------|-----------|-------------------------|
| 3709 675    | Fe        | I                       | 3716 293              |           | 0000 N                  |
| 3709 808    | Fe        | I                       | 3716 517              |           | 00                      |
| 3709 967    |           | 000                     | 3716 591 s            | Fe        | 7                       |
| 3710 094    | Ti        | 0                       | 3716 677              |           | 00                      |
| 3710 214    |           | 00                      | 3716 838              |           | 0000                    |
| 3710 304    |           | 000                     | 3716 905              |           | 0000                    |
| 3710 431 s  | Y         | 3                       | 3717 084              |           | 000 N                   |
| 3710 587    |           | 00 N                    | 3717 211              |           | 000                     |
| 3710 777    |           | 00 N                    | 3717 326              |           | 00                      |
| 3710 880    |           | 000                     | 3717 410              |           | 0000                    |
| 3711 020    |           | 000 N                   | 3717 539              | Ti        | 2                       |
| 3711 254    |           | 000                     | 3717 695              |           | 0000 N                  |
| 3711 364    | Fe        | 4                       | 3717 812              |           | 0000                    |
| 3711 440    |           | 000                     | 3717 872              |           | 0000                    |
| 3711 552    | Fe        | 3                       | 3717 975              |           | 0                       |
| 3711 674    |           | 000                     | 3718 093              |           | 000 N                   |
| 3711 804    |           | 000 N                   | 3718 291              |           | 0 N                     |
| 3711 923    |           | 000 N                   | 3718 367              |           | 000                     |
| 3712 079    |           | 0                       | 3718 460              |           | 000                     |
| 3712 229    |           | 00                      | 3718 554              | Fe        | 4                       |
| 3712 319    | Co        | 00                      | 3718 665              |           | 0000                    |
| 3712 443    |           | 000                     | 3718 754              |           | 000 N                   |
| 3712 539    |           | 000                     | 3718 845              |           | 0000                    |
| 3712 666    |           | 000                     | 3718 978              |           | 0000                    |
| 3712 856    |           | 000                     | 3719 070              | Mn, Pd    | 1                       |
| 3712 906    |           | 000                     | 3719 168              |           | 0000                    |
| 3713 037    |           | { 2                     | 3719 332              |           | 0000 N                  |
| 3713 087    | Cl        | { 3                     | 3719 405              |           | 0000                    |
| 3713 239    |           | 000                     | 3719 545              |           | 0000 N                  |
| 3713 346    |           | 000                     | 3719 598              |           | 000 N                   |
| 3713 479    | Ni        | 00                      | 3719 683              |           | 000 N                   |
| 3713 693    |           | 000 N                   | 3719 796 <sup>1</sup> |           | 0 N                     |
| 3713 853    | Ti        | 0                       | 3719 905              |           | 0000 N                  |
| 3713 973    |           | 000                     | 3720 084 s            | Fe        | 40                      |
| 3714 109    |           | 000 N                   | 3720 184              |           | 0000                    |
| 3714 296    |           | 000 N                   | 3720 305              |           | 0 N                     |
| 3714 359    |           | 000 N                   | 3720 400              |           | 000 N                   |
| 3714 546    |           | 000                     | 3720 544              |           | 00 Nd?                  |
| 3714 706    |           | 000                     | 3720 704              |           | 0000Nd?                 |
| 3714 813    |           | 000                     | 3720 832              |           | 0000 N                  |
| 3714 926    | Zr        | 0                       | 3720 930              |           | 0000                    |
| 3715 069    |           | 000                     | 3721 048              |           | 0000                    |
| 3715 179    |           | 000                     | 3721 171              |           | 0000                    |
| 3715 319    |           | 2                       | 3721 212              |           | 0000                    |
| 3715 536    |           | 0000                    | 3721 326              |           | 2                       |
| 3715 615    | Mn?       | 4                       | 3721 418              | Fe        | 3                       |
| 3715 853    |           | 0000 N                  | 3721 540              | Fe        | 2                       |
| 3715 938    |           | 0000                    | 3721 647              | Fe        | 2                       |
| 3716 054    | Fe        | 3                       | 3721 779              | Ti        | 4 d?                    |
| 3716 172    |           | 0000                    |                       |           |                         |

<sup>1</sup>This line is variable, though not an atmospheric line





PRELIMINARY TABLE OF SOLAR SPECTRUM  
WAVE-LENGTHS

II



PRELIMINARY TABLE  
.  
OF  
SOLAR SPECTRUM WAVE-LENGTHS

BY  
HENRY A ROWLAND

PART II

CHICAGO  
*The University of Chicago Press*  
1898

| Wave length    | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|----------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3722 071       | Fe        | 3                       | 3729 096    | Ni        | 1 d?                    |
| 3722 174       |           | 2                       | 3729 214    | C?        | 000 N                   |
| 3722 280       |           | 00                      | 3729 481    |           | 0                       |
| 3722 377       |           | 1                       | 3729 666    |           | 00                      |
| 3722 518       |           | 0 N                     | 3729 865    |           | 000                     |
| 3722 639       | Ni        | 3                       | 3729 952    | Ti        | 3                       |
| (3722 692) } s |           | 10                      | 3730 154    |           | 00                      |
| 3722 729       | Ti-Fe     | 6                       | 3730 283    |           | 000                     |
| 3722 899       |           | 0                       | 3730 450    |           | 1                       |
| 3722 987       |           | 000                     | 3730 534    | Fe        | 3                       |
| 3723 319       |           | 000                     | 3730 625    | Co        | 2                       |
| 3723 425       |           | 00                      | 3730 732    |           | 00                      |
| 3723 533       |           | 00                      | 3730 898    | Ni        | 1                       |
| 3723 651       |           | 00                      | 3730 950    | Cr        | 1                       |
| 3723 750       |           | 1                       | 3731 093    | Fe        | 3                       |
| 3723 827       |           | 00                      | 3731 301    |           | 00                      |
| 3723 985       |           | 0                       | 3731 403    | Co-Zr     | 0                       |
| 3724 053       |           | 00                      | 3731 523    | Fe        | 3                       |
| 3724 233       | Ti        | 1                       | 3731 763    |           | 00                      |
| 3724 399       |           | 000                     | 3731 869    |           | 00                      |
| 3724 526       | Fe        | 6                       | 3731 956    | Mn        | 000                     |
| 3724 716       | Ti        | 1                       | 3732 072    |           | 0                       |
| 3724 884       |           | 00                      | 3732 177    | Cr        | 2                       |
| 3724 970       | Ni        | 1                       | 3732 284    |           | 00                      |
| 3725 090       |           | 0 N d?                  | 3732 356    |           | 000                     |
| 3725 300       | Ti        | 1                       | 3732 545 s  | Ti-Fe Co  | 6                       |
| 3725 447       |           | 0                       | 3732 776    | C-        | 0 N d?                  |
| 3725 638       |           | 3                       | 3732 894    |           | 2                       |
| 3725 806       |           | 00                      | 3733 028    |           | 000                     |
| 3725 978       |           | 000                     | 3733 128    |           | 000                     |
| 3726 164       |           | 0                       | 3733 222    |           | 000                     |
| 3726 206       |           | 00                      | 3733 338    |           | 1                       |
| 3726 558       |           | 000 N d?                | 3733 469 s  | Fe-       | 7 d?                    |
| 3726 806       | Co        | 0                       | 3733 635    | Co        | 1 N                     |
| 3726 983       |           | 00                      | 3733 798    |           | 000                     |
| 3727 061       | Fe Mn     | 4 d?                    | 3733 910    |           | 00                      |
| 3727 167       |           | 0                       | 3733 984    |           | 000                     |
| 3727 244       | Fe        | 3                       | 3734 160    |           | 00 N                    |
| 3727 488       |           | 1                       | 3734 278    | Co        | 1                       |
| 3727 590       |           | 0                       | 3734 428    |           | 000                     |
| 3727 672       |           | 1                       | 3734 608    |           | 00 N                    |
| 3727 778 } s   | Fe        | 4 } d                   | 3734 679    |           | 1                       |
| 3727 826 } s   |           | 1 }                     | 3734 807    |           | 0 N                     |
| 3727 965       |           | 2                       | 3735 014 s  | Fe        | 40                      |
| 3728 183       |           | 1                       | 3735 135    |           | 00                      |
| 3728 278       |           | 00                      | 3735 261    |           | 0 N                     |
| 3728 474       |           | 0 N                     | 3735 387    |           | 000                     |
| 3728 544       |           | 00                      | 3735 485    | Fe        | 4                       |
| 3728 813       | Ti-Fe     | 2                       | 3735 587    |           | 000                     |
| 3729 004       | Mn        | 00                      | 3735 694    |           | 000                     |

| Wave length | Substance | Intensity and Character | Wave length  | Substance | Intensity and Character |
|-------------|-----------|-------------------------|--------------|-----------|-------------------------|
| 3735 843    | Co        | o N d?                  | 3742 286     | C?        | 1                       |
| 3736 041    |           | 1                       | 3742 418     |           | 00                      |
| 3736 107    |           | 0                       | 3742 707     |           | 2                       |
| 3736 187    |           | 00                      | 3742 763     | Fe        | 3                       |
| 3736 321    |           | 000                     | 3743 086     | Cr        | 1                       |
| 3736 434    |           | 000                     | 3743 269     | Fe        | 00                      |
| 3736 619    |           | 00                      | 3743 358     |           | 0                       |
| 3736 734    |           | 000                     | 3743 508 s   |           | 0                       |
| 3736 854    |           | 000                     | 3743 626     |           | 2                       |
| 3736 958 s  | Ni        | 3                       | 3743 726     | Cr        | 1                       |
| 3737 059 s  |           | 5                       | 3743 926     | Cr        | 1                       |
| 3737 174    | Ca-Mn     | 00                      | 3744 029     |           | 2                       |
| 3737 281 s  |           | 30                      | 3744 138     | Fe        | 000                     |
| 3737 441    |           | 1 N d?                  | 3744 251     |           | 4                       |
| 3737 718    |           | 00 N                    | 3744 303     | Cr        | 000                     |
| 3737 900    |           | 00                      | 3744 513     |           | 000                     |
| 3738 026    |           | 00                      | 3744 634     |           | 0                       |
| 3738 128    |           | 000                     | 3744 697     |           | 1                       |
| 3738 211    |           | 00                      | 3744 898     | Ni        | 000                     |
| 3738 281    |           | 000                     | 3744 959     |           | 000                     |
| 3738 454    | Fe        | 3                       | 3745 190     | Co        | 000                     |
| 3738 466    |           | 6 } d                   | 3745 279     |           | 000                     |
| 3738 505    |           | 2 }                     | 3745 371     |           | 00                      |
| 3738 652    |           | 1                       | 3745 491     |           | 2                       |
| 3738 773    |           | 000                     | 3745 617     |           | 1                       |
| 3738 900    |           | 00                      | 3745 717 s   |           | 8                       |
| 3738 946    |           | 000                     | 3745 751     |           | 1                       |
| 3739 140    |           | 00                      | 3746 058 s   |           | 6                       |
| 3739 260    |           | 2                       | 3746 191     |           | 0                       |
| 3739 370    | Fe        | 3                       | 3746 287     | Ni        | 000                     |
| 3739 467    | Ni        | 1                       | 3746 387     |           | 1                       |
| 3739 674    | Fe        | 3                       | 3746 511     | Fe        | 00                      |
| 3739 926    | Ni        | 1                       | 3746 618     |           | 2                       |
| 3740 085    | Bi?       | 000                     | 3746 717     | Mn        | 1                       |
| 3740 205    | Fe        | 2                       | 3746 864     | Fe        | 00                      |
| 3740 386    | Fe        | 3                       | 3747 065 }   |           | 3 }                     |
| 3740 477    |           | 0                       | 3747 147 } s |           | 2 }                     |
| 3740 605    |           | 0000                    | 3747 369     |           | 0                       |
| 3740 672    |           | 0000                    | 3747 492     | Ti        | 00                      |
| 3740 952    |           | 0000                    | 3747 694     |           | 1                       |
| 3741 025    |           | 0000                    | 3747 864     |           | 000                     |
| 3741 205    | Li        | 4                       | 3747 965     |           | 00                      |
| 3741 339    |           | 00                      | 3748 144     | Ti?       | 1                       |
| 3741 453    |           | 0                       | 3748 232     |           | 0 N                     |
| 3741 619    |           | 1                       | 3748 408 s   | Fe        | 10                      |
| 3741 701    |           | 0                       | 3748 549     |           | 0                       |
| 3741 791    | Li        | 4                       | 3748 650     |           | 1                       |
| 3741 973    | C         | 000                     | 3748 749     |           | 0                       |
| 3742 043    | C         | 00                      | 3748 821     | Cr        | 1                       |
| 3742 219    | Fe        | 1                       | 3748 943     |           | 000                     |

| Wave length  | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|--------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3749 049     | Fe        | 0                       | 3755 863    |           | 00                      |
| 3749 110     | Cr        | 2                       | 3755 964    |           | 00                      |
| 3749 195     | Ni        | 1                       | 3756 080    |           | 000                     |
| 3749 388     |           | 0 N                     | 3756 213 s  | Fe        | 3                       |
| 3749 509     |           | 00 N                    | 3756 405    | C?        | 00                      |
| 3749 631 s   | re        | 20                      | 3756 480    | C?        | 00                      |
| 3749 764     |           | 0                       | 3756 705    | Mn        | 000                     |
| 3749 884     |           | 000                     | 3756 791    | C         | 00                      |
| 3749 994     | C?        | 00                      | 3757 081    | Fe        | 4                       |
| 3750 082     | Co        | 0                       | 3757 212    |           | 000                     |
| 3750 283     | C?        | 000                     | 3757 304    | Cl        | 1                       |
| 3750 349     | C?        | 0000 { N                | 3757 444    | C?        | 0                       |
| 3750 448     |           | 1                       | 3757 508    | C?        | 00                      |
| 3750 648     |           | 000 N                   | 3757 597    | Fe        | 2                       |
| 3750 823     |           | 1                       | 3757 824    | Cl 11     | 4                       |
| 3750 916     | Mn        | 00                      | 3757 950    |           | 00 N                    |
| 3751 015     |           | 2                       | 3758 099    |           | 0                       |
| 3751 136     |           | 000                     | 3758 173    |           | 0                       |
| 3751 234     | Fe        | 1                       | 3758 269    |           | 00                      |
| 3751 367     |           | 0 N                     | 3758 375 s  | Fe        | 15                      |
| 3751 592     |           | 00 N                    | 3758 456    |           | 0                       |
| 3751 735     | Co        | 1                       | 3758 577    |           | 0                       |
| 3751 802     | Zi        | 00                      | 3758 736    |           | 0 N                     |
| 3751 967     | Fe        | 1                       | 3758 863    |           | 00 N                    |
| 3752 055     |           | 000                     | 3758 967    |           | 00 N                    |
| 3752 334     | C         | 000                     | 3759 096    |           | 0 N                     |
| 3752 408     | C         | 000                     | 3759 215    | Zr        | 1                       |
| 3752 556     | Fe        | 3                       | 3759 297    | La Fe     | 2                       |
| 3752 648     |           | 000                     | 3759 447    | Ti        | 12d?                    |
| 3752 830     |           | 00                      | 3759 613    |           | 0                       |
| 3753 003     | Ti        | 4                       | 3759 725    |           | 1                       |
| 3753 134     |           | 1                       | 3759 829    |           | 00                      |
| 3753 282     | Fe        | 2                       | 3759 940    |           | 00                      |
| 3753 482     |           | 1                       | 3760 032    | C?        | 000                     |
| 3753 667     |           | 000                     | 3760 196    | Fe        | 5                       |
| 3753 732     | Fe Ti     | 6                       | 3760 364    |           | 1                       |
| 3753 893     |           | 00                      | 3760 531    | C?        | 00 N                    |
| 3754 009     |           | 000                     | 3760 679    | Fe        | 4                       |
| 3754 265     |           | 000                     | 3760 844    |           | 00                      |
| 3754 367     | C         | 00                      | 3761 070    | C         | 00                      |
| 3754 481     | Co C      | 00 N                    | 3761 206    |           | 1                       |
| 3754 647 } s |           | 3 {                     | 3761 464    | Ti        | 7                       |
| 3754 719 } s |           | 1 }                     | 3761 568    | Fe        | 2                       |
| 3754 866     |           | 000                     | 3761 695    | C         | 000                     |
| 3755 015     |           | 00 N                    | 3761 830    | C-        | 1 N                     |
| 3755 147     |           | 000                     | 3762 012    | li        | 3                       |
| 3755 275     |           | 0                       | 3762 349    |           | 2                       |
| 3755 421     |           | 00                      | 3762 448    | C-        | 1                       |
| 3755 593     | Co        | 1 N                     | 3762 495    | C-        | 1                       |
| 3755 714     |           | 00                      | 3762 616    |           | 000                     |

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3762 758    | C         | I                       | 3770 132 s  | Fe        | 4                       |
| 3762 895    |           | ooo                     | 3770 308    | C         | oo                      |
| 3763 008    |           | oo N                    | 3770 446    | C-Fe      | 2                       |
| 3763 147    |           | 2                       | 3770 553    |           | 2                       |
| 3763 313    |           | ooo N                   | 3770 671    |           | ooo                     |
| 3763 426    |           | oooo                    | 3770 739    |           | 1                       |
| 3763 514    |           | ooo                     | 3770 859    |           | o N                     |
| 3763 614    |           | oo                      | 3770 992    |           | ooo                     |
| 3763 709    |           | I                       | 3771 116    |           | 2                       |
| 3763 945 s  |           | 10                      | 3771 258    |           | oo                      |
| 3764 117    | Fe        | o N                     | 3771 418    | C         | ooo                     |
| 3764 251    |           | I                       | 3771 471 *  | C         | oo                      |
| 3764 359    |           | I                       | 3771 636    |           | I                       |
| 3764 422    |           | oo                      | 3771 798    | Fe-C      | 2                       |
| 3764 522    |           | oo N                    | 3771 956    | C         | oo                      |
| 3764 727    |           | oo                      | 3772 111    |           | ooo                     |
| 3764 787    |           | oo                      | 3772 250    | C         | o N                     |
| 3764 986    |           | oo                      | 3772 330    | C         | oo                      |
| 3765 059    |           | ooo                     | 3772 524    |           | ooo                     |
| 3765 194    |           | oo                      | 3772 673    | Ni        | 2                       |
| 3765 441    |           | o                       | 3772 730    |           | I                       |
| 3765 689    | Fe        | 6                       | 3772 918    |           | ooo                     |
| 3765 847    | Fe        | I                       | 3773 070    | C         | o N d?                  |
| 3766 234    | Fe        | 2                       | 3773 345    | C         | oo N                    |
| 3766 377    | C         | oo                      | 3773 503    |           | I                       |
| 3766 460    | C         | ooo N                   | 3773 609    | C         | oo                      |
| 3766 594    | C         | oo                      | 3773 695    | C         | oo                      |
| 3766 801    | Fe        | 3                       | 3773 803    | Fe        | 3                       |
| 3766 955    | Fe        | I                       | 3774 020    |           | oo                      |
| 3767 105    |           | I                       | 3774 170    | C         | oo                      |
| 3767 218    |           | o                       | 3774 247    | C         | oo                      |
| 3767 341 s  | Fe        | 8                       | 3774 357    |           | oooo                    |
| 3767 493    |           | I N                     | 3774 473 s  | Y         | 3                       |
| 3767 574    |           | o                       | 3774 650    | C         | ooo                     |
| 3767 682    | C         | oo                      | 3774 791    | Fe-C      | I                       |
| 3767 787    | Mn        | o                       | 3774 971    | Fe        | 4                       |
| 3767 842    |           | oo                      | 3775 137    |           | ooo                     |
| 3768 034    |           | oo                      | 3775 342    | C         | oo                      |
| 3768 173    | Fe        | 3                       | 3775 431    | C         | oo                      |
| 3768 232    | C         | ooo                     | 3775 562    |           | ooo                     |
| 3768 385    | C Cr-Fe C | 2                       | 3775 717    | Ni        | 7                       |
| 3768 544    |           | o                       | 3775 849    | Tl        | ooo                     |
| 3768 799    |           | o                       | 3775 997    |           | I                       |
| 3768 871    | Cr        | I                       | 3776 090    | C         | oo                      |
| 3769 157    |           | o N                     | 3776 198    | Ti        | 2                       |
| 3769 454    |           | oo N                    | 3776 337    | C         | o N                     |
| 3769 603    |           | 3                       | 3776 473    |           | ooo N                   |
| 3769 792    |           | ooo                     | 3776 600    | Fe        | 3                       |
| 3769 861    |           | oo                      | 3776 698    | Mn        | I                       |
| 3769 752    | C         | oo                      | 3776 830    |           | ooo                     |

\* Haze, which is perhaps due to Hydrogen

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3776 977    |           | 000 N                   | 3783 224    |           | 000                     |
| 3777 057    |           | 000                     | 3783 328    |           | 00                      |
| 3777 210    | Fe C      | 2                       | 3783 483    |           | 2                       |
| 3777 370    |           | 000                     | 3783 601    | C         | 00                      |
| 3777 470    |           | 1                       | 3783 674 s  | Ni        | 6                       |
| 3777 593    | Fe        | 3                       | 3783 954    | C         | 00                      |
| 3777 701    | C         | 000                     | 3784 035    | C         | 00                      |
| 3777 809    | C         | 00                      | 3784 391    |           | 0                       |
| 3777 897    | C         | 00                      | 3784 511    | C         | 00                      |
| 3777 982    | C         | 0                       | 3784 641    | C         | 0                       |
| 3778 075    | C         | 0                       | 3784 814    |           | 000 N                   |
| 3778 203    | Ni        | 2                       | 3784 965    |           | 000 N                   |
| 3778 301    |           | 0                       | 3785 152    |           | 000                     |
| 3778 463    | Fe        | 3                       | 3785 223    |           | 000                     |
| 3778 652    | Fe        | 2                       | 3785 373    |           | 0                       |
| 3778 841    | V Fe C    | 3                       | 3785 457    | C         | 0                       |
| 3778 939    | C         | 1                       | 3785 539    | C         | 0                       |
| 3779 049    |           | 000                     | 3785 641    | C         | 00                      |
| 3779 165    |           | 00                      | 3785 719    | C         | 00                      |
| 3779 236    |           | 0000                    | 3785 846    | Fe        | 1                       |
| 3779 343    | C         | 1                       | 3785 929    |           | 1                       |
| 3779 451    | C         | 00                      | 3786 092    | Fe        | 3                       |
| 3779 569    | Fe        | 4                       | 3786 181    | Li        | 1                       |
| 3779 657    | Fe        | 2                       | 3786 314    | Fe        | 4 d                     |
| 3779 713    |           | 0                       | 3786 468    |           | 1                       |
| 3779 871    | C         | 0                       | 3786 587    |           | 1                       |
| 3779 989    | C         | 0                       | 3786 661    |           | 0                       |
| 3780 083    |           | 000                     | 3786 820    | Fe        | 5                       |
| 3780 223    | C         | 000                     | 3786 983    |           | 00                      |
| 3780 363    | C         | 000                     | 3787 104    |           | 000                     |
| 3780 564    | C         | 00                      | 3787 240    | Ci        | 000                     |
| 3780 654    | C         | 00                      | 3787 304    | Fe C      | 1                       |
| 3780 842 s  |           | 3                       | 3787 379    | C         | 0                       |
| 3780 994    | C         | 00                      | 3787 558    |           | 000                     |
| 3781 128    |           | 000 Nd?                 | 3787 620    |           | 000                     |
| 3781 330 s  | Fe        | 3                       | 3787 713    |           | 00                      |
| 3781 460    |           | 00                      | 3787 852    |           | 00 N                    |
| 3781 655    |           | 00                      | 3787 922    |           | 0                       |
| 3781 754    | C         | 1                       | 3788 046 s  | Fe        | 0                       |
| 3781 818    | C         | 00                      | 3788 180    |           | 00                      |
| 3781 935    |           | 000                     | 3788 283    |           | 00                      |
| 3782 078    | Fe        | 2                       | 3788 353    |           | 000                     |
| 3782 258    | Li Fe     | 1                       | 3788 574    | C         | 0                       |
| 3782 354    | C         | 0                       | 3788 666    | C         | 00                      |
| 3782 455    | C         | 00                      | 3788 839    |           | 2                       |
| 3782 592    | Fe        | 2                       | 3788 953    | C         | 0                       |
| 3782 755    | Fe        | 1                       | 3788 999    | Cr        | 1                       |
| 3782 868    |           | 000                     | 3789 110    | C         | 0                       |
| 3782 987    |           | 000                     | 3789 186    | C         | 0                       |
| 3783 135    | C         | 000                     | 3789 319    | Fe        | 3                       |



# TABLE OF SOLAR SPECTRUM WAVE-LENGTHS

9

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3789 439    |           | 0                       | 3795 441    | C         | 0                       |
| 3789 553    | Fe        | 1 N                     | 3795 513    | C         | 00                      |
| 3789 637    |           | 0                       | 3795 593    |           | 0                       |
| 3789 719    | Fe        | 1                       | 3795 680    | Fe        | 1                       |
| 3789 867    |           | 0                       | 3795 880    | C         | 00                      |
| 3789 991    |           | 1                       | 3795 952    | C         | 00                      |
| 3790 059    |           | 000                     | 3796 040    |           | 0                       |
| 3790 238    | Fe        | 5                       | 3796 154    |           | 0                       |
| 3790 362    | Mn        | 2 N                     | 3796 247    | C         | 0                       |
| 3790 471    | V?        | 00                      | 3796 329    | C         | 0                       |
| 3790 585    | C         | 0                       | 3796 449    | C?        | 00                      |
| 3790 629    | Cl C      | 1                       | 3796 531    |           | 0                       |
| 3790 793    |           | 1                       | 3796 635    |           | 0                       |
| 3790 910    | Fe-C      | 2                       | 3796 943    |           | 1                       |
| 3790 972    | La-Ca     | 1                       | 3797 032    | C         | 2                       |
| 3791 132    |           | 000                     | 3797 115    | C         | 00                      |
| 3791 246    | C         | 0                       | 3797 205    | C         | 000                     |
| 3791 332    | C         | 000                     | 3797 283    | Cl C      | 0                       |
| 3791 517    | Cr C      | 1                       | 3797 387    | C         | 00                      |
| 3791 645    | Fe-C      | 2                       | 3797 597    |           | 00                      |
| 3791 885    |           | 1                       | 3797 659    | Fe        | 5                       |
| 3792 041    |           | 000 N                   | 3797 860    | Cl        | 1                       |
| 3792 216    | C         | 00                      | 3797 991    | C         | 0                       |
| 3792 294    | Fe Cr C   | 3                       | 3798 093    | Fe C      | 2                       |
| 3792 482    | Ni        | 1                       | 3798 224    |           | 00                      |
| 3792 702    | C         | 0                       | 3798 306    |           | 000                     |
| 3792 788    | C         | 0                       | 3798 396    | Mo        | 0                       |
| 3792 824    |           | 2                       | 3798 486    |           | 000                     |
| 3792 969    | Fe-C      | 2                       | 3798 655    | Fe        | 6                       |
| 3793 069    | C         | 000                     | 3798 791    | C         | 0                       |
| 3793 128    |           | 000                     | 3798 912    |           | 000                     |
| 3793 262    |           | 000 N                   | 3799 047    |           | 0                       |
| 3793 429    | Cr        | 1                       | 3799 159    |           | 000                     |
| 3793 495    |           | 1                       | 3799 272    | C         | 00                      |
| 3793 622    | Fe        | 2                       | 3799 386    | Mn C      | 1 Nd                    |
| 3793 745    | Ni        | 4                       | 3799 486    |           | 00                      |
| 3793 846    | C         | 000                     | 3799 586    |           | 0                       |
| 3793 921    | C         | 00                      | 3799 693    | Fe        | 7                       |
| 3794 016 s  | Fe        | 2                       | 3799 818    | C         | 0                       |
| 3794 107    |           | 000                     | 3799 934    | V         | 1                       |
| 3794 225    |           | 000                     | 3800 046    |           | 0                       |
| 3794 313    |           | 000                     | 3800 174    | C         | 0                       |
| 3794 485    | Fe-C      | 4                       | 3800 256    | C         | 0                       |
| 3794 555    | C         | 0                       | 3800 457    | C?        | 0 N                     |
| 3794 679    |           | 0                       | 3800 683    | Mn        | 1                       |
| 3794 753    | Cr        | 0                       | 3800 766    |           | 0                       |
| 3794 909    | La        | 1                       | 3800 877    |           | 00                      |
| 3795 032    | V         | 1 N                     | 3800 992    |           | 0                       |
| 3795 147 s  | Fe        | 8                       | 3801 163    | Sn?       | 000                     |
| 3795 292    |           | 1 N                     | 3801 251    |           | 0                       |

\* Haze which is perhaps due to Hydrogen

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3801 331    |           | 0                       | 3807 293    | Ni        | 6                       |
| 3801 439    | C         | 0                       | 3807 425    |           | 00                      |
| 3801 511    | G         | 1                       | 3807 530    |           | 00                      |
| 3801 679    | -C        | 0 N d?                  | 3807 681    | Fe        | 6                       |
| 3801 820    | Fe        | 3                       | 3807 831    | C         | 00                      |
| 3801 953    | Fe        | 2                       | 3807 914    |           | 000                     |
| 3802 051    | Mn        | 00                      | 3808 076    | Cl C      | 1                       |
| 3802 133    |           | 2                       | 3808 223    | Co        | 0                       |
| 3802 271    |           | 00                      | 3808 274    | 11 Ni C   | 1                       |
| 3802 424    | Fe        | 2                       | 3808 423    | Fe        | 1                       |
| 3802 614    |           | 00                      | 3808 650    | V         | 0                       |
| 3802 725    |           | 000                     | 3808 770    |           | 000                     |
| 3802 870    | C         | 0                       | 3808 873    | Fe        | 3                       |
| 3802 952    | C         | 0                       | 3809 189    | C         | 1                       |
| 3803 097    |           | 0                       | 3809 305    | C         | 0                       |
| 3803 141    | C         | 0                       | 3809 552    | C         | 00                      |
| 3803 228    | C         | 1                       | 3809 633    | Mn C      | 00                      |
| 3803 317    | C         | 00                      | 3809 724    | Mn        | 4                       |
| 3803 398    |           | 1                       | 3809 834    | Mn C      | 0                       |
| 3803 618    | V?        | 0                       | 3809 894    | C         | 0                       |
| 3803 711    |           | 00                      | 3810 061    | C         | 00                      |
| 3803 816    |           | 00                      | 3810 174    |           | 00 d?                   |
| 3803 910    |           | 000                     | 3810 434    |           | 00 d?                   |
| 3804 044    | C         | 00                      | 3810 681    | C         | 0                       |
| 3804 151 s  | Fe        | 3                       | 3810 761    | C         | 0                       |
| 3804 237    | C         | 00                      | 3810 854    | C         | 000                     |
| 3804 317    | C         | 00                      | 3810 901    | Fe C      | 3                       |
| 3804 424    |           | 0                       | 3811 047    |           | 0                       |
| 3804 484    |           | 000                     | 3811 181    | -C        | 1                       |
| 3804 621    |           | 00 N                    | 3811 317    |           | 000                     |
| 3804 752    | -C        | 1                       | 3811 443    | -C        | 1                       |
| 3804 836    | C         | 1                       | 3811 525    | C         | 0                       |
| 3804 934    | Fe-Cr C   | 2                       | 3811 667    |           | 000 N                   |
| 3805 070    |           | 00                      | 3811 787    |           | 000 N                   |
| 3805 256    | C         | 00                      | 3811 945    | Fe        | 2                       |
| 3805 337    | C         | 00                      | 3812 033    |           | 2                       |
| 3805 486 s  | Fe        | 6                       | 3812 126    | C         | 0                       |
| 3805 589    | C         | 00                      | 3812 205    | C         | 0                       |
| 3805 669    | C         | 00                      | 3812 340    | C         | 000                     |
| 3805 884    |           | 0 N                     | 3812 389    |           | 00                      |
| 3805 989    |           | 00                      | 3812 589    |           | 000                     |
| 3806 103    |           | 000                     | 3812 733    |           | 000                     |
| 3806 255    | C         | 0                       | 3812 813    |           | 000                     |
| 3806 357    | Fe C      | 2                       | 3813 000    |           | 0 N                     |
| 3806 511    | C         | 0                       | 3813 100    | Fe        | 5                       |
| 3806 586    | C         | 0                       | 3813 219    | Fe        | 2                       |
| 3806 711    |           | 00                      | 3813 405    | C         | 0                       |
| 3806 865    | Mn Fe     | 8 d?                    | 3813 537    | C         | 2                       |
| 3807 012    | V Mn C    | 0                       | 3813 637    | V C       | 0                       |
| 3807 148    |           | 000                     | 3813 781    | Fe        | 2                       |

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3814 034    | Fe        | 2 { d                   | 3819 938    | C?        | { 00                    |
| 3814 070    |           | 1 { d                   | 3820 042    |           | 0 { d                   |
| 3814 154    |           | 0                       | 3820 102    | C         | 0 { d                   |
| 3814 264    |           | 0                       | 3820 197    |           | 00 N                    |
| 3814 386    |           | 000                     | 3820 337    |           | 0 N                     |
| 3814 500    | C         | 00                      | 3820 444    |           | 0 N                     |
| 3814 671    | Fe C      | 4 { d                   | 3820 586 s  | Fe C      | 25                      |
| (3814 698)  |           | 8 { d                   | 3820 702    | C         | 1                       |
| 3814 738    | C         | 3 { d                   | 3820 797    | C?        | 0                       |
| 3814 796    | C         | 1                       | 3820 889    | C         | 1                       |
| 3815 038    | C         | 0                       | 3820 950    | C         | 0                       |
| 3815 222    |           | 00 N                    | 3821 017    |           | 0                       |
| 3815 352    |           | 00 N                    | 3821 130    |           | 00                      |
| 3815 462    |           | 1                       | 3821 328 s  | Fe        | 4                       |
| 3815 572    | Cl        | 1                       | 3821 636    |           | 00                      |
| 3815 759    |           | 0 N                     | 3821 725    |           | 00                      |
| 3815 987 s  | Fe        | 15 {                    | 3821 866    | C         | 1 N                     |
| 3816 252    | C?        | 0 N                     | 3821 981    | Fe        | 4                       |
| 3816 332    | C?        | 0                       | 3822 077    | Li        | 0                       |
| 3816 490    | Fe-Co     | 3 {                     | 3822 157    | V         | 0                       |
| 3816 610    | Co        | 1                       | 3822 250    |           | 000                     |
| 3816 779    | C         | 00 N                    | 3822 406    | C         | 0                       |
| 3816 887    | Mn        | 1                       | 3822 470    | C         | 0                       |
| 3816 998    |           | 0000                    | 3822 557    |           | 000                     |
| 3817 059    |           | 1                       | 3822 785    |           | 00                      |
| 3817 114    |           | 000                     | 3822 924    |           | 000                     |
| 3817 198    | C         | 00                      | 3822 996    | V         | 1 d                     |
| 3817 290    | C         | 000                     | 3823 092    | C?        | 00                      |
| 3817 523    | Co Li C   | 0                       | 3823 163    |           | 0                       |
| 3817 602    |           | 00                      | 3823 228    | C         | 0                       |
| 3817 725    |           | 00                      | 3823 352    |           | 0                       |
| 3817 786    | Fe C      | 3                       | 3823 493    |           | 00 N                    |
| 3817 877    | C         | 0                       | 3823 653 s  | Mn Cl     | 4                       |
| 3817 985    | Li-Cl-C   | 0                       | 3823 893    | C         | 0                       |
| 3818 080    |           | 000                     | 3823 953    | C         | 0                       |
| 3818 225    |           | 000                     | 3824 028    | Mn        | 1                       |
| 3818 337    | C         | 00                      | 3824 139    | C?        | 00                      |
| 3818 378    | V-C       | 1                       | 3824 216    | Fe        | 1                       |
| 3818 487    |           | 1                       | 3824 373    |           | 000                     |
| 3818 613    | Cl        | 0                       | 3824 441    |           | { 2                     |
| 3818 759    | C         | 1                       | 3824 591    | Fe        | 6                       |
| 3818 891    | C?        | 000                     | 3824 711    |           | 1                       |
| 3819 031    |           | 000                     | 3824 780    |           | 000                     |
| 3819 197    | C         | 1 N d?                  | 3824 887    |           | 00                      |
| 3819 346    | C         | 1                       | 3824 936    |           | 0                       |
| 3819 412    | C         | 1                       | 3825 057    |           | 1                       |
| 3819 521    | C         | 00                      | 3825 183    |           | 000                     |
| 3819 637    |           | 2                       | 3825 256    |           | 00                      |
| 3819 715    | Cl        | 0                       | 3825 373    | C         | 0                       |
| 3819 829    | C         | 1 N d?                  | 3825 448    | C         | 0                       |

| Wave length | Substance | Intensity and Character | Wave length  | Substance      | Intensity and Character |
|-------------|-----------|-------------------------|--------------|----------------|-------------------------|
| 3825 543    |           | 2                       | 3831 334     |                | 00 Nd?                  |
| 3825 736    |           | 1 N                     | 3831 517     | -C             | 00 N                    |
| 3825 820    |           | 1 N                     | 3831 657     |                | 000                     |
| 3826 027 s  | Fe        | 20                      | 3831 837     | N <sub>1</sub> | 6                       |
| 3826 163    |           | 0 N                     | 3832 025     | C              | 0                       |
| 3826 229    |           | 0                       | 3832 171     |                | 0                       |
| 3826 343    | C?        | 0                       | 3832 303     |                | 0                       |
| 3826 449    | C?        | 0                       | 3832 450 s   | Mg             | 15                      |
| 3826 555    |           | 1                       | 3832 647     | C              | 0                       |
| 3826 636    |           | 000                     | 3832 790     |                | 0                       |
| 3826 761    |           | 1 N                     | 3832 890     |                | 000                     |
| 3826 843    | C         | 0                       | 3833 026     |                | 3 N                     |
| 3826 905    | C         | 00                      | 3833 156     | C              | 0                       |
| 3826 988    | C         | 2                       | 3833 221     | C-             | 1                       |
| 3827 096    | C         | 0                       | 3833 348     |                | 0                       |
| 3827 220    |           | 0                       | 3833 458     | Fe             | 4                       |
| 3827 348    |           | 00                      | 3833 628     |                | 000 N                   |
| 3827 435    |           | 1                       | 3833 744     | C              | 0                       |
| 3827 519    | C         | 0                       | 3833 836     |                | 0                       |
| 3827 622    |           | 000                     | 3833 916     | C              | 0                       |
| 3827 714    |           | 2                       | 3834 006     | Mn C           | 3                       |
| 3827 828    |           | 1 N                     | 3834 096     |                | 000                     |
| 3827 980 s  | Fe        | 8                       | 3834 189     |                | 0 N                     |
| 3828 155    |           | 1 N                     | 3834 364     | Fe             | 10                      |
| 3828 296    | Li C      | 1                       | 3834 506     | Mn             | 4                       |
| 3828 360    | C         | 0                       | 3834 614     |                | 0                       |
| 3828 539    |           | 00                      | 3834 609     | C              | 0                       |
| 3828 646    | V         | 0                       | 3834 762     | C              | 000                     |
| 3828 702    |           | 0                       | 3834 869     |                | 0                       |
| 3828 795    |           | 000                     | 3834 978     |                | 00 N                    |
| 3828 971    |           | 00                      | 3835 022     |                | 000                     |
| 3829 108    |           | 000                     | 3835 176     |                | 00 N                    |
| 3829 195    |           | 000                     | 3835 298     | C              | 0                       |
| 3829 284    | Fe        | 1                       | 3835 342     | C              | 0                       |
| 3829 386    |           | 00                      | 3835 509     | C              | 1 d?                    |
| 3829 501 s  | Mg        | 10                      | 3835 689     | C              | 0 N d?                  |
| 3829 617    | Ti-C      | 2                       | 3835 862     | -C             | 000 d                   |
| 3829 728    | Fe C      | 0                       | 3836 116     |                | 000                     |
| 3829 822    | Li-C      | 1                       | 3836 229 s   |                | 2                       |
| 3829 909    |           | 1                       | 3836 337     | C              | 000                     |
| 3830 037    |           | 000                     | 3836 476     | Fe             | 3                       |
| 3830 211    |           | 0                       | 3836 639 } s | C              | 1 } d                   |
| 3830 447    |           | 000                     | 3836 689 }   | C              | 1 }                     |
| 3830 513    |           | 0                       | 3836 808     |                | 000                     |
| 3830 627    |           | 0                       | 3836 905     |                | 1                       |
| 3830 745    | C         | 0                       | 3837 059     |                | 1                       |
| 3830 801    | C         | 0                       | 3837 277     |                | 2                       |
| 3830 896    | Fe        | 2                       | 3837 404     |                | 000                     |
| 3831 002    | Fe        | 2                       | 3837 559     | C              | 0 N d?                  |
| 3831 174    | C-        | 3 d                     | 3837 768     | C              | 1 d?                    |

\* Haze, which is perhaps due to Hydrogen

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3837 961    | C         | 0                       | 3844 714    |           | 0                       |
| 3838 035    | C         | 0                       | 3844 861    |           | 00 N                    |
| 3838 188    |           | 0 N                     | 3845 023    |           | 0                       |
| 3838 345    |           | 1 N                     | 3845 149    | C         | 1                       |
| 3838 435 s  | Mg C      | 25                      | 3845 310    | Fe        | 3                       |
| 3838 675    |           | 0 N                     | 3845 358    |           | 1                       |
| 3838 888    | C         | 1 N d?                  | 3845 461    | C         | 000                     |
| 3839 135    |           | 0                       | 3845 606    | Co-C      | 8 d?                    |
| 3839 275    | C         | 1                       | 3845 729    |           | 000                     |
| 3839 405    | Fe        | 3                       | 3845 837    |           | 1                       |
| 3839 582    |           | 0                       | 3845 949    | C         | 00 N d?                 |
| 3839 762    | Fe        | 2                       | 3846 131    | C         | 2                       |
| 3839 922    | Mn-C      | 2                       | 3846 421    |           | 1                       |
| 3839 987    | C         | 0                       | 3846 554    | Fe        | 2                       |
| 3840 067    |           | 00                      | 3846 666    |           | 00                      |
| 3840 239    | C?        | 0                       | 3846 777    | C         | 1                       |
| 3840 340    | Mn        | 0                       | 3846 814    | C         | 1                       |
| 3840 440    | V         | 0 N                     | 3846 943    | Fe        | 5                       |
| 3840 580 s  | Fe C      | 8                       | 3847 087    | C         | 1                       |
| 3840 720    |           | 0 N                     | 3847 121    | C         | 00                      |
| 3840 893    | V         | 1 N                     | 3847 261    |           | 000 N                   |
| 3841 034    | C         | 0 N d?                  | 3847 394    | C         | 00 N                    |
| 3841 195    | Fe-Mn     | 10                      | 3847 477    | V         | 00                      |
| 3841 327    |           | 0                       | 3847 567    |           | 00                      |
| 3841 420    | Cr        | 1                       | 3847 654    |           | 000                     |
| 3841 486    |           | 00                      | 3847 827    |           | 000                     |
| 3841 595    | Co        | 0                       | 3847 961    | C         | 1                       |
| 3841 720    |           | 000 N                   | 3848 006    | C         | 1                       |
| 3841 862    | C         | 2 d?                    | 3848 100    | C         | 0                       |
| 3841 959    | C         | 0                       | 3848 186    |           | 00                      |
| 3842 082    | C         | 0                       | 3848 249    |           | 00                      |
| 3842 191    | Co        | 3                       | 3848 329    | C         | 00                      |
| 3842 354    | -C?       | 0 d?                    | 3848 432    |           | 2                       |
| 3842 500    |           | 000                     | 3848 580    |           | 000                     |
| 3842 587    | C         | 00                      | 3848 667    |           | 00                      |
| 3842 779    | C         | 0                       | 3848 745    |           | 00                      |
| 3842 904    |           | 000                     | 3848 840    |           | 00                      |
| 3843 038    |           | 1                       | 3848 979    | C         | 1 N                     |
| 3843 127    | C         | 3                       | 3849 140    | La C      | 3 d?                    |
| 3843 195    | Fe C      | 2                       | 3849 248    |           | 000                     |
| 3843 404 s  | Fe        | 4                       | 3849 400    |           | 000                     |
| 3843 600    | C         | 0 N                     | 3849 501    | C?        | 1 N                     |
| 3843 762    |           | 000                     | 3849 675    |           | 1                       |
| 3843 854    |           | 2 N                     | 3849 886    | C         | 0 N                     |
| 3843 962    |           | 000                     | 3850 013    |           | 0                       |
| 3844 135    | Mn-C      | 2                       | 3850 118    | Fe        | 10                      |
| 3844 167    |           | 0000                    | 3850 300    | C         | 1 N d?                  |
| 3844 267    |           | 000                     | 3850 440    |           | 00                      |
| 3844 378    | Ar, He C  | 4 d?                    | 3850 536    |           | 00                      |
| 3844 587    | V         | 0                       | 3850 626    |           | 0                       |

| Wave-length | Substance | Intensity and Character | Wave length | Substance        | Intensity and Character |
|-------------|-----------|-------------------------|-------------|------------------|-------------------------|
| 3850 700    |           | 00                      | 3856 674    |                  | 0                       |
| 3850 781    | C?        | 0                       | 3856 802    | C?               | 2 N                     |
| 3850 962    | Fe        | 4                       | 3856 955    |                  | 000                     |
| 3851 098    | Co?       | 0                       | 3857 063    | C?               | 0                       |
| 3851 220    |           | 000                     | 3857 135    | C?               | 000                     |
| 3851 306    |           | 00                      | 3857 215    | C?               | 000                     |
| 3851 427    | C         | 2 N d?                  | 3857 288    | C?               | 1                       |
| 3851 580    |           | 000                     | 3857 473    | C                | 0                       |
| 3851 672    | C         | 0                       | 3857 580    | C                | 00                      |
| 3851 733    | C         | 00                      | 3857 805    | C?               | 6 d?                    |
| 3851 815    | C         | 00                      | 3857 955    | C?               | 0                       |
| 3851 895    |           | 00                      | 3858 033    | C?               | 1                       |
| 3851 993    | Co C      | 00                      | 3858 146    | C?               | 00                      |
| 3852 132    |           | 000                     | 3858 262    |                  | 1 N                     |
| 3852 245    | C         | 00                      | 3858 442    | N <sub>1</sub>   | 7                       |
| 3852 347    | C-        | 1                       | 3858 606    | C                | 0                       |
| 3852 541    | C?        | 2 N d?                  | 3858 642    | C                | 000                     |
| 3852 714    | Fe        | 4                       | 3858 722    | C                | 0                       |
| 3852 845    | C         | 00                      | 3858 822    | C                | 2 N                     |
| 3852 899    | C         | 000                     | 3859 000    |                  | 1 N                     |
| 3853 045    | C         | 00                      | 3859 052    | C?               | 1                       |
| 3853 184    |           | 00                      | 3859 128    | C                | 00                      |
| 3853 233    | C         | 1 d?                    | 3859 246    | C?               | 00                      |
| 3853 477    | -C        | 0 N                     | 3859 355    | Fe               | 3                       |
| 3853 620    | C         | 2 d?                    | 3859 415    | C                | 000                     |
| 3853 805    | C         | 00                      | 3859 535    |                  | 000                     |
| 3853 872    | C-        | 0                       | 3859 568    | C?               | 0                       |
| 3853 967    | C         | 000                     | 3859 788    | C-N <sub>1</sub> | 0                       |
| 3854 040    | C         | 00                      | 3859 876    | C                | 00                      |
| 3854 191    | C         | 0                       | 3860 055 s  | Fe C             | 20                      |
| 3854 343    |           | 0                       | 3860 227    | C-               | 0 N                     |
| 3854 401    |           | 00                      | 3860 354    | C?               | 0 N                     |
| 3854 507    |           | 2                       | 3860 427    |                  | 00                      |
| 3854 707    | C         | 2 N d?                  | 3860 566    | C                | 0                       |
| 3854 808    | C         | 0                       | 3860 630    | C                | 0                       |
| 3854 869    | C         | 0                       | 3860 767    | C-N <sub>1</sub> | 3 N                     |
| 3854 989    | C         | 1                       | 3860 863    | C                | 000                     |
| 3855 088    | C         | 00                      | 3860 903    | C                | 0                       |
| 3855 259    | C?        | 00                      | 3861 067    | C                | 00                      |
| 3855 450    | V         | 2                       | 3861 158    | C-               | 0                       |
| 3855 547    |           | 1                       | 3861 158    | C-Co C           | 4 N d?                  |
| 3855 721    | Fe C      | 1                       | 3861 299    | C-Fe             | 3                       |
| (3855 749)  |           | 5 } d                   | 3861 479    |                  | 00                      |
| 3855 766    | C         | 3                       | 3861 592    | C                | 1                       |
| 3855 989    | V         | 4                       | 3861 681    | C                | 2                       |
| 3856 107    |           | 00                      | 3861 734    | C                | 2 N                     |
| 3856 161    |           | 1                       | 3861 847    | C                | 1 N                     |
| 3856 282    |           | 000                     | 3861 978    | C                | 1 N                     |
| 3856 367    |           | 0                       | 3862 114    |                  | 000                     |
| 3856 524 s  | Fe        | 8                       | 3862 248    |                  | 000                     |
|             |           |                         | 3862 361    |                  |                         |

| Wave length           | Substance           | Intensity and Character | Wave length           | Substance | Intensity and Character |
|-----------------------|---------------------|-------------------------|-----------------------|-----------|-------------------------|
| 3862 458              | C                   | 00                      | 3867 996              | C?        | 000                     |
| 3862 541              | C                   | 000                     | 3868 060              | -C        | 2                       |
| 3862 627              | C?                  | 2                       | 3868 171              | C         | 00                      |
| 3862 727              |                     | 1                       | 3868 261              | C         | 0                       |
| 3862 827              | C                   | 000                     | 3868 372              | C         | 0                       |
| 3862 897              | C                   | 00                      | 3868 451              |           | 000                     |
| 3862 962              |                     | 0                       | 3868 539              | C         | 1                       |
| 3863 041              | C                   | 00                      | 3868 625              | C         | 00                      |
| 3863 113              | C                   | 00                      | 3868 700              | C         | 0                       |
| 3863 201              | <i>for 113, 115</i> | 1                       | 3868 785              | C         | 00                      |
| 3863 341              |                     | 000 N                   | 3868 873              | C         | 1                       |
| 3863 533              | C                   | 3 N                     | 3868 941              | C         | 0                       |
| 3863 655              | C                   | 00                      | 3869 179              | C         | 0                       |
| 3863,734              | C                   | 00                      | 3869 305              | C         | 1                       |
| 3863 835              | C-                  | 1                       | 3869 444              | C         | 0 N d?                  |
| 3863 888              | Fe                  | 3                       | 3869 533              | C-        | 1                       |
| 3864 006              |                     | 0                       | 3869 692              | Fe C      | 3                       |
| 3864 113              | C                   | 0                       | 3869 745              | C         | 1                       |
| 3864 246              | Mo C                | 1                       | 3869 805              | C         | 1                       |
| 3864 438 <sup>s</sup> | C                   | 3                       | 3869 960              | C         | 00                      |
| 3864 626              | C                   | 1                       | 3870 053              | C-Co      | 1 N                     |
| 3864 720              | C                   | 00                      | 3870 204              | C         | 0                       |
| 3864 802              | C                   | 00                      | 3870 289              | C-        | 1 N                     |
| 3865 005              | V                   | 3 N d?                  | 3870 405              | C?        | 00                      |
| 3865 134              | C                   | 0                       | 3870 493              | C?        | 0                       |
| 3865 213              | C                   | 000                     | 3870 615              | C-        | 1                       |
| 3865 282              | C?                  | 3                       | 3870 685              | C         | 0 N                     |
| 3865 454              | C                   | 0                       | 3870 797              | C         | 0 } d                   |
| 3865 554              | C                   | 0                       | 3870 848              | C         | 00 }                    |
| 3865 674              | Fe-C                | 7                       | 3870 932              | C         | 0                       |
| 3865 793              | C                   | 0                       | 3871 018              | C         | 1                       |
| 3866 046              | C?                  | 000                     | 3871 145              | C         | 0                       |
| 3866 122              | C?                  | 3 N d?                  | 3871 259              | C         | 0                       |
| 3866 238              | C                   | 00                      | 3871 356              | C-        | 1                       |
| 3866 306              | C                   | 00                      | 3871 527 <sup>s</sup> | C         | 2 d?                    |
| 3866 380              | C                   | 00                      | 3871 693              | C         | 0                       |
| 3866 526              | C                   | 00                      | 3871 785              |           | 00                      |
| 3866 577              | C                   | 1                       | 3871 963              | Fe        | 2                       |
| 3866 692              | C                   | 0                       | 3872 035              |           | 0                       |
| 3866 854              |                     | 0                       | 3872 202              | C-        | 1 N                     |
| 3866 960              | C-                  | 2                       | 3872 312              | C         | 0                       |
| 3867 118              | C                   | 0                       | 3872 405              | C-        | 1 N                     |
| 3867 205              | C                   | 0                       | 3872 639              | Fe        | 6                       |
| 3867 356              | Fe-C                | 3                       | 3872 859              | C         | 1 N d?                  |
| 3867 449              | C                   | 0                       | 3872 969              |           | 00                      |
| 3867 520              | C                   | 0                       | 3873 065              | -Co       | 2                       |
| 3867 573              |                     | 0                       | 3873 224              | Co        | 2                       |
| 3867 758              | C-V                 | 1                       | 3873 267              |           | 2                       |
| 3867 791              | C                   | 0                       | 3873 333              |           | 00                      |
| 3867 906              | C-                  | 1                       | 3873 427              |           | 0                       |

\*Beginning of the second head of "Cyanogen band"

| Wave-length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3873 504    | C         | 0                       | 3879 458    | C         | 0                       |
| 3873 636    | C         | 0                       | 3879 578    | C         | 000                     |
| 3873 706    | C-        | 1                       | 3879 716    | C         | 1                       |
| 3873 903    | Fe        | 4                       | 3879 796    | C         | 0                       |
| 3874 091    | Co C      | 4                       | 3879 851 }  | C         | 0                       |
| 3874 191    |           | 1                       | 3879 986    | C         | 00                      |
| 3874 258    | C         | 00                      | 3880 105 }  | C         | 1                       |
| 3874 328    | C         | 0                       | 3880 175 }  | C         | 0                       |
| 3874 491    |           | 000 Nd?                 | 3880 235    | C         | 0                       |
| 3874 651    |           | 2                       | 3880 328    | C         | 0                       |
| 3874 708    | -C        | 0                       | 3880 393    |           | 0000                    |
| 3874 861    | C         | 1                       | 3880 465 }  | C         | 1                       |
| 3874 911    | C         | 2                       | 3880 532 }  | C         | 2                       |
| 3875 220 s  | V         | 2                       | 3880 596 }  | C         | 1                       |
| 3875 425    | Ti C      | 2 Nd?                   | 3880 684    | C         | 000                     |
| 3875 513    | C         | 1                       | 3880 815 }  | C         | 1                       |
| 3875 681    |           | 00 N                    | 3880 931 }  | C         | 1                       |
| 3875 793    |           | 00                      | 3881 038    | C         | 000                     |
| 3875 920    | C-        | 2                       | 3881 140    | C         | 1                       |
| 3876 019    | C         | 0                       | 3881 254    | C         | 1                       |
| 3876 083    | C         | 0                       | 3881 346    | C         | 0                       |
| 3876 194    | Fe        | 5                       | 3881 445 }  | C         | 2                       |
| 3876 448    | C         | 0                       | 3881 543 }  | C         | 1                       |
| 3876 556 }  | C         | 0                       | 3881 628    | C         | 000                     |
| 3876 622 }  | C         | 0                       | 3881 729 }  | C         | 1                       |
| 3876 702    |           | 000                     | 3881 825 }  | C         | 1                       |
| 3876 815    | Fe        | 1                       | 3882 011    | C-Co      | 2                       |
| 3876 981    | Co-C      | 4                       | 3882 118    | C         | 1                       |
| 3877 121    | C         | 4 Nd?                   | 3882 224    | C         | 1                       |
| 3877 232    |           | 00                      | 3882 309    | C         | 1                       |
| 3877 337    |           | 1 N                     | 3882 439    | C-        | 2                       |
| 3877 481    | C         | 1                       | 3882 530    | C         | 1                       |
| 3877 587 }  | C         | 0                       | 3882 650    | C         | 1                       |
| 3877 646 }  | C         | 0                       | 3882 733    | C         | 1                       |
| 3877 745    |           | 00                      | 3882 828    | C         | 1                       |
| 3877 845    |           | 000                     | 3882 893    | C         | 1                       |
| 3877 972    | C         | 0                       | 3882 986    | C         | 0                       |
| 3878 072    | C         | 00                      | 3883 033    | C         | 1                       |
| 3878 152    | Fe-C      | 8                       | 3883 133    | C         | 2                       |
| 3878 334    |           | 1                       | 3883 253    | C         | 1                       |
| 3878 438    | C-        | 2                       | 3883 339    | C         | 0                       |
| 3878 549    | C         | 0 d?                    | 3883 426 }  | C-        | 2                       |
| 3878 720    | Fe        | 7 Nd?                   | 3883 533 }  | C         | 1 N                     |
| 3878 816    | Co Fe     | 2                       | 3883 568 s  |           |                         |
| 3878 884    | C-Fe      | 2                       | 3883 690    |           | 000                     |
| 3878 975    | C         | 0                       | 3883 778 s  | Cr        | 0                       |
| 3879 037    | C         | 0                       | 3884 236    |           | 000                     |
| 3879 178    | C?        | 00 N                    | 3884 361    |           | 00                      |
| 3879 331    | C         | 1                       | 3884 431    |           | 0                       |
| 3879 394    | C         | 0                       | 3884 518    | Fe        | 2                       |

\*First line in first head of "Cyanogen band" This line and the preceding one were measured together as a single line in the series of measurements upon which were based Rowland's Table of Standards

<sup>a</sup>Edge of "Cyanogen band"



TABLE OF SOLAR SPECTRUM WAVE-LENGTHS

17

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3884 579    |           | 00                      | 3891 918    |           | 0                       |
| 3884 748    | Ca        | 1                       | 3892 069    | Fe        | 4                       |
| 3884 812    | Fe        | 1                       | 3892 153    |           | 000                     |
| 3884 986    |           | 0                       | 3892 373    |           | 00                      |
| 3885 101    |           | 00                      | 3892 450    |           | 0                       |
| 3885 207    |           | 00                      | 3892 590    |           | 00                      |
| 3885 290    | Fe        | 2                       | 3892 698    | Mn        | 2                       |
| 3885 364    | Fe Cr     | 2                       | 3892 873    |           | 000                     |
| 3885 426    | Co        | 00                      | 3893 033    | V Fe      | 2                       |
| 3885 657    | Fe        | 4                       | 3893 124    |           | 1                       |
| 3885 797    |           | 00                      | 3893 213    |           | 1                       |
| 3885 895    |           | 1                       | 3893 352    |           | 000                     |
| 3886 005    |           | 0                       | 3893 451    |           | 2                       |
| 3886 073    |           | 0                       | 3893 542    | Fe        | 4                       |
| 3886 205    |           | 00 N                    | 3893 600    |           | 0                       |
| 3886 295    |           | 00 Nd?                  | 3893 743    |           | 000                     |
| 3886 434 s  | Fe        | 15                      | 3893 932    |           | 000                     |
| 3886 568    | V         | 0                       | 3894 057    | Fe        | 2                       |
| 3886 942    | Cr        | 3                       | 3894 165    | Cr        | 3                       |
| 3887 080    |           | 00                      | (3894 211)  |           | 8 } d                   |
| 3887 196    | Fe        | 7                       | 3894 241    | Co        | 5                       |
| 3887 512    |           | 000 N                   | 3894 355    |           | 0000                    |
| 3887 666    |           | 000 N                   | 3894 511    |           | 0000                    |
| 3887 870    |           | 000 N                   | 3894 630    |           | 1 N                     |
| 3888 030    |           | 00                      | 3894 768    |           | 00                      |
| 3888 179    | Li        | 0                       | 3894 850    | Mn        | 0                       |
| 3888 560    |           | 2                       | 3895 119    | Co        | 3                       |
| 3888 671    | Fe        | 5                       | 3895 224    | Ce        | 1                       |
| 3888 863    |           | 00 N                    | 3895 304    |           | 00                      |
| 3888 971    | Fe-Mn     | 2                       | 3895 377    | Ti        | 2                       |
| 3889 077    |           | 0                       | 3895 470    |           | 1                       |
| 3889 245    |           | 1                       | 3895 583    | Mn        | 3                       |
| 3889 374    |           | 1 Nd?                   | 3895 719    |           | 0                       |
| 3889 498    | Mn        | 1 d?                    | 3895 803    | Fe        | 7                       |
| 3889 675    |           | 00 N                    | 3895 931    |           | 0                       |
| 3889 810    | Ni        | 2                       | 3896 279    | V?        | 0                       |
| 3889 986    |           | 0                       | 3896 385    | Mn        | 00                      |
| 3890 069    |           | 1                       | 3896 500    |           | 00                      |
| 3890 222    |           | 000                     | 3896 608    |           | 1                       |
| 3890 336    | V         | 1 N                     | 3896 671    |           | 0                       |
| 3890 450    |           | 000                     | 3896 759    | Zr        | 0                       |
| 3890 538    | Fe-Zr     | 2                       | 3896 917    | Ce        | 0 N                     |
| 3890 707    |           | 1 N                     | 3897 119    |           | 000                     |
| 3890 861    |           | 00                      | 3897 210    |           | 000                     |
| 3890.986    | Fe        | 3                       | 3897 336    |           | 000                     |
| 3891 084    |           | 00                      | 3897 482    |           | 000                     |
| 3891 339    |           | 1 N                     | 3897 596 s  | Fe        | 2                       |
| 3891 521    |           | 0                       | 3897 785    | Zr        | 0                       |
| 3891 649    |           | 1 N                     | 3897 915    |           | 0                       |
| 3891 820    |           | 000                     | 3898 032    | Fe        | 3                       |

\* Haze, which is perhaps due to Hydrogen

| Wave length | Substance | Intensity and Character | Wave-length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3898 151    | V         | 5                       | 3905 017    |           | I                       |
| 3898 231    | Fe        | 2                       | 3905 146    |           | I                       |
| 3898 414    |           | 00                      | 3905 326    |           | 2                       |
| 3898 531    | Mn        | 2                       | 3905 497    |           | 1 N                     |
| 3898 645    | Ti        | 0                       | 3905 660 s  | Si        | 12                      |
| 3898 911    |           | 000 N                   | 3905 816    |           | 2 N                     |
| 3899 015    |           | 0000                    | 3905 906    |           | 1 N                     |
| 3899 171    | Fe        | 3                       | 3906 044    |           | 3                       |
| 3899 277    |           | 2                       | 3906 169    |           | 00                      |
| 3899 463    |           | 000                     | 3906 318    |           | 000                     |
| 3899 530    | Mn        | 0                       | 3906 438    | Co        | 2                       |
| 3899 701    | Mn        | 0 N                     | 3906 539    |           | 000                     |
| 3899 850    | Fe        | 8                       | 3906 628    | Fe        | 10                      |
| 3899 963    |           | 0 N                     | 3906 763    |           | 00                      |
| 3900 361    |           | 0                       | 3906 890    | Fe        | 4                       |
| 3900 470    |           | 000                     | 3907 099    |           | I                       |
| 3900 549    |           | 0                       | 3907 251    |           | 0 Nd?                   |
| 3900 681    | Ti Fe-Zr  | 5                       | 3907 368    |           | 00                      |
| 3900 797    |           | 000                     | 3907 433    |           | 000                     |
| 3900 907    |           | 000                     | 3907 615    | Fe-Sc     | 3 d?                    |
| 3900 973    |           | 0                       | 3907 807    |           | I                       |
| 3901 114    | Ti        | I                       | 3907 910    |           | I                       |
| 3901 197    |           | 000                     | 3908 077    | Fe        | 5                       |
| 3901 297    |           | 00                      | 3908 203    |           | 000                     |
| 3901 474    |           | 00 Nd                   | 3908 310    |           | 0000                    |
| 3901 621    |           | 00                      | 3908 410    |           | I                       |
| 3901 735    |           | 2                       | 3908 546    |           | 0                       |
| 3901 878    |           | 000                     | 3908 684    |           | 0                       |
| 3902 002    |           | 3                       | 3908 821    |           | 00                      |
| 3902 114    | Fe        | I                       | 3908 900    | Cr        | 4                       |
| 3902 241    |           | 0                       | 3909 064    |           | I                       |
| 3902 399    | V         | 3                       | 3909 211    |           | 000                     |
| 3902 567    |           | 1 N                     | 3909 423    |           | 0                       |
| 3902 768    |           | 2 N                     | 3909 538    |           | 0000                    |
| 3902 916    |           | 0                       | 3909 638    |           | 00                      |
| 3903 090    | Fe-Cr     | 10                      | 3909 802    | Fe        | 4                       |
| 3903 216    |           | 0                       | 3909 863    |           | 000                     |
| 3903 302    |           | I                       | 3909 976    | Fe        | 5                       |
| 3903 398    |           | 2                       | 3910 079    | Co-Ca     | 3 Nd?                   |
| 3903 553    |           | 000                     | 3910 211    |           | 000                     |
| 3903 683    |           | 00 Nd?                  | 3910 348    |           | 000                     |
| 3903 868    |           | 000                     | 3910 469    |           | 2                       |
| 3903 991    |           | 2                       | 3910 615    |           | 0                       |
| (3904 023)  |           | 8 } d                   | 3910 670    |           | 2                       |
| 3904 052    | Fe        | 5                       | 3910 802    |           | 0                       |
| 3904 213    | Co        | 0                       | 3910 984    | Fe-V      | 4                       |
| 3904 467    |           | 00                      | 3911 135    |           | 3                       |
| 3904 613    |           | 000                     | 3911 230    |           | 00                      |
| 3904 767    |           | 0                       | 3911 316    | *Nd       | 0                       |
| 3904 926    | Ti        | 3                       | 3911 444    |           | 000                     |

\*Nd is the symbol for Neodymium

# PRELIMINARY TABLE OF SOLAR SPECTRUM WAVE-LENGTHS II

By HENRY A. ROWLAND

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3911 554    | Mn        | o Nd?                   | 3917 400    |           | o                       |
| 3911 708    |           | ooo                     | 3917 731    | Cr        | o                       |
| 3911 836    | Fe        | 1                       | 3917 893    |           | ooo                     |
| 3911 963    | Sc        | 2                       | 3918 007    |           | o N d?                  |
| 3912 127    | Cr?       | 2 N                     | 3918 223    |           | o N                     |
| 3912 224    |           | o                       | 3918 396    | Mn        | o                       |
| 3912 341    | V?        | o                       | 3918 464    | Fe        | 4                       |
| 3912 445    | Ni?       | 2                       | 3918 563    | Fe        | 4                       |
| 3912 561    |           | o                       | 3918 713    |           | o                       |
| 3912 732    |           | oo                      | 3918 789    | Fe        | 5                       |
| 3912 935    | Fe        | o                       | 3918 929    |           | oo                      |
| 3913 030    |           | oo                      | 3919 035    |           | o                       |
| 3913 123    | Ni        | 2                       | 3919 208    | Fe        | 3                       |
| 3913 282    |           | ooo N                   | 3919 309    | Cr        | 3                       |
| 3913 395    |           | 1                       | 3919 499    |           | ooo N                   |
| 3913 609    | Ti-Fe     | 5 d?                    | 3919 708    |           | o N d?                  |
| 3913 775    | Fe        | 4                       | 3919 869    |           | o                       |
| 3914 153    | Ce?       | 1 N                     | 3919 956    | Cr        | o                       |
| 3914 320    |           | o                       | 3920 114    |           | o                       |
| 3914 426    | Fe?       | 3                       | 3920 264    | Co?       | 1                       |
| 3914 477    | Li        | 2                       | 3920 410    | Fe        | 10                      |
| 3914 566    |           | 1                       | 3920 591    |           | o N?                    |
| 3914 652    | Ni?       | 1                       | 3920 768    | Fe        | 1                       |
| 3914 880    | Fe        | o N                     | 3920 868    | Co        | 1 N                     |
| 3915 094    |           | o N                     | 3920 984    | Fe        | 2                       |
| 3915 359    | Fe        | 1                       | 3921 105    |           | o                       |
| 3915 612    | Fe, Cr    | 1                       | 3921 188    | Cr-Nd     | 3                       |
| 3915 751    |           | 3                       | 3921 326    |           | 1                       |
| 3915 951    | Cr-       | 5 d?                    | 3921 415    | Fe        | 1                       |
| 3916 079    | Zr        | 1                       | 3921 563    | Ti        | 1                       |
| 3916 207    | Zi-La     | o N d?                  | 3921 605    | La-       | 4                       |
| 3916 383    | Cr        | 2                       | 3921 855    | Zr-Mn     | 4                       |
| 3916 545    |           | 3                       | 3922 043    |           | o N d?                  |
| 3916 661    | Mn        | oo                      | 3922 159    |           | oo                      |
| 3916 745    | Zr        | oo                      | 3922 223    | Mn        | 1                       |
| 3916 879 s  | Fe        | 5                       | 3922 560    | V         | 1 N                     |
| 3916 992    |           | oo                      | 3922 815    | Mn        | 1                       |
| 3917 125    |           | o                       | 3922 907    | Co        | o                       |
| 3917 264    | Co        | 2                       | 3923 054    | Fe        | 12 d?                   |
| 3917 324    | Fe        | 5                       | 3923 180    |           | 1                       |

| Wave length    | Substance | Intensity and Character | Wave length  | Substance      | Intensity and Character |
|----------------|-----------|-------------------------|--------------|----------------|-------------------------|
| 3923 246       |           | 0                       | 3930 654     |                | 0                       |
| 3923 375       | Mn        | 00                      | 3930 804     |                | 0                       |
| 3923 472       | Sc        | 0                       | 3931 030     |                | 0                       |
| 3923 641       |           | 0                       | 3931 269     | Fe             | 1                       |
| 3923 831       |           | 00 N                    | 3931 483     |                | 0 N                     |
| 3924 065       |           | 000                     | 3931 729     | Mn?            | 1 N                     |
| 3924 206       | Mn        | 1                       | 3932 039     |                | 0 N                     |
| 3924 313       |           | 1                       | 3932 161     | I <sub>1</sub> | 1                       |
| 3924 492       |           | 00 N                    | 3932 395     |                | 0                       |
| 3924 673 s     | Ti        | 4                       | 3932 625     |                | 00 N                    |
| 3924 791       |           | 0                       | 3932 785     | Fe             | 1                       |
| 3924 929       |           | 00                      | 3933 056     | Fe             | 0                       |
| 3925 153       |           | 00 N                    | 3933 523     |                | 8 N                     |
| 3925 347 s     | Co, Fe?   | 4                       | 3933 825 s K | Ca             | 1000                    |
| 3925 491       |           | 000                     | 3934 108     | Co             | 8 N                     |
| 3925 677       |           | 1                       | 3934 174     |                | 0 N                     |
| 3925 790 s     | Fe        | 5                       | 3934 661     |                | 0 N                     |
| 3925 939       |           | 000                     | 3934 818     | Co?, Fe?       | 0                       |
| 3926 086       | Fe        | { 4                     | 3935 358     |                | 00 N d?                 |
| (3926 123) } s |           |                         | 3935 463     | Co, Fe         | 1                       |
| 3926 165       |           |                         | 3935 588     | , Mn?          | 00                      |
| 3926 320       |           | 3                       | 3935 787     |                | 0 N d?                  |
| 3926 465       | Ti        | 000 N                   | 3935 965     | Fe             | 2                       |
| 3926 597       | Mn        | 0                       | 3936 121     | Co             | 2                       |
| 3926 779       | Cr        | 2 N                     | 3936 507     |                | 00                      |
| 3926 917       |           | 000                     | 3936 699     |                | 0                       |
| 3927 079       |           | 0 N d?                  | 3936 912     | Mn-            | 0 N d?                  |
| 3927 269       |           | 0                       | 3937 105     |                | 00 N d?                 |
| 3927 392       |           | 000                     | 3937 283     |                | 00 N d?                 |
| 3927 484       |           | 00                      | 3937 479 s   | Fe             | 3                       |
| 3927 585       |           | 1                       | 3937 58c     |                | 000                     |
| 3927 748       |           | 0                       | 3937 695     |                | 00                      |
| 3927 937       |           | 1 N d?                  | 3937 972     | Mn-            | 00 N                    |
| 3928 075 s     | Fe        | 8                       | 3938 116     |                | 0                       |
| 3928 231       | Fe        | 2                       | 3938 160     |                | 1                       |
| 3928 357       | -Cr?      | 2 N d?                  | 3938 326     |                | 000                     |
| 3928 485       |           | 2 N                     | 3938 439     |                | 2                       |
| 3928 636       |           | 00                      | 3938 552     |                | 4                       |
| 3928 783       | Cr        | 3                       | 3938 772     |                | 0                       |
| 3928 904       |           | 000                     | 3938 876     |                | 00                      |
| 3929 124       |           | 000 N                   | 3939 007     |                | 0                       |
| 3929 260       | Fe Co     | 2                       | 3939 112     |                | 00                      |
| 3929 363       | Fe-La-Mn  | 2                       | 3939 288     |                | 0                       |
| 3929 497       | Co?       | 1                       | 3939 532     |                | 00 N                    |
| 3929 663       |           | 0 N                     | 3939 659     |                | 00                      |
| 3929 864       | Mn?       | 0 N d?                  | 3939 736     |                | 00                      |
| 3930 022       | Ti        | 2                       | 3940 026     |                | 00 N                    |
| 3930 180       |           | 0 N                     | 3940 183     | Fe?            | 2                       |
| 3930 291       |           | 000                     | 3940 324     |                | 00                      |
| 3930 450       | Fe        | 8                       | 3940 499     |                | 0 N d?                  |

TABLE OF SOLAR SPECTRUM WAVE-LENGTHS 21

| Wave length    | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|----------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 3940 812       |           | 0                       | 3947 300    |           | 00                      |
| 3941 025 s     | Fe, Co    | 5                       | 3947 522    |           | 2                       |
| 3941 190       |           | 0                       | 3947 675    | Fe        | 4                       |
| 3941 323       |           | 1                       | 3947 830    |           | 1                       |
| 3941 424       | Fe?       | 3                       | 3947 918    | Ti        | 2                       |
| 3941 510       |           | 000                     | 3948 117    |           | 000                     |
| 3941 637       | Cr        | 3                       | 3948 246    | Fe        | 5                       |
| 3941 753       |           | 00                      | 3948 420    |           | 1                       |
| 3941 878       | Co        | 3                       | 3948 613    |           | 00 N                    |
| 3941 997       |           | 1                       | 3948 818    | Ti        | 4                       |
| 3942 157       | Mn?       | 0 N                     | 3948 925    | Fe        | 4                       |
| 3942 296       | Ce?       | 1                       | 3949 039 s  | Ca        | 1                       |
| 3942 380       |           | 0                       | 3949 199    | La        | 1                       |
| 3942 510       |           | 2                       | 3949 286    | Fe        | 2                       |
| (3942 558) } s |           |                         | 3949 372    |           | 1                       |
| 3942 586       | Fe        | 3                       | 3949 544    |           | 00                      |
| 3942 747       |           | 000                     | 3949 753    |           | 0                       |
| 3942 886       | Co Ce     | 0                       | 3949 959    |           | 0                       |
| 3942 984       | Mn        | 0                       | 3950 102 s  | Fe        | 5                       |
| 3943 238       |           | 2                       | 3950 278    |           | 0                       |
| 3943 322       |           | 2                       | 3950 398    |           | 000                     |
| 3943 489       | Fe        | 3                       | 3950 497 s  | Y         | 2                       |
| 3943 622       |           | 0 N                     | 3950 613    |           | 0                       |
| 3943 721       |           | 1                       | 3950 938    |           | 000                     |
| 3943 819       |           | 00                      | 3951 219    | Ci        | 1                       |
| 3943 960       |           | 1                       | 3951 311    | Fe        | 5                       |
| 3944 058       |           | 0                       | 3951 449    |           | 00                      |
| 3944 160 s     | Al        | 15                      | 3951 578    |           | 00                      |
| 3944 319       |           | 1 N                     | 3951 765    | Y         | 0 N d?                  |
| 3944 492       |           | 0                       | 3951 917    | Ci        | 0 N                     |
| 3944 681       |           | 00 N                    | 3951 978    |           | 000                     |
| 3944 824       |           | 1                       | 3952 103    | Mn        | 2                       |
| 3944 884       | Fe?       | 2                       | 3952 235    |           | 00                      |
| 3945 033       | Fe        | 3                       | 3952 342    | Na?       | 0                       |
| 3945 128       | Co        | 1                       | 3952 465    | Co        | 0                       |
| 3945 260       | Fe        | 3                       | 3952 549    | Cr        | 0                       |
| 3945 358       |           | 1                       | 3952 606"   |           | 000                     |
| 3945 473       | Co        | 3 N                     | 3952 683    |           | 000                     |
| 3945 633       | Ci?       | 00                      | 3952 754    | Fe        | 4                       |
| 3945 827       |           | 00 N d?                 | 3952 850    | Fe,-      | 3                       |
| 3945 993       | Mn?       | 1                       | 3952 894    |           | 0                       |
| 3946 101       | Cr?       | 00                      | 3953 043    | Mn        | 3                       |
| 3946 188       | Fe        | 0                       | 3953 120    | Co        | 3                       |
| 3946 340       |           | 0                       | 3953 222    |           | 1                       |
| 3946 599       |           | 00                      | 3953 303    | Fe-Cr     | 3                       |
| 3946 693       |           | 0                       | 3953 400    |           | 0                       |
| 3946 800       | Co        | 0                       | 3953 550    |           | 00                      |
| 3946 953       |           | 000 N                   | 3953 641    |           | 1                       |
| 3947 142       | Fe        | 3                       | 3953 804    |           | 000                     |
| 3947 272       | Co        | 0                       | 3953 844    |           | 0000                    |

| Wave length | Substance | Intensity and Character | Wave length   | Substance | Intensity and Character |
|-------------|-----------|-------------------------|---------------|-----------|-------------------------|
| 3954 002 s  | Fe        | 3                       | 3961 281      | Fe        | 3                       |
| 3954 104    |           | 000                     | 3961 422      |           | 0 N                     |
| 3954 190    |           | 0 N                     | 3961 538      |           | 1 N                     |
| 3954 414    |           | 000                     | 3961 674 s    | Al        | 20                      |
| 3954 536    |           | 00                      | 3961 947      |           | 0                       |
| 3954 680    | Ni, Mn    | 2                       | 3962 056      |           | 1                       |
| 3954 857    | Fe?       | 1                       | 3962 222      | Fe?       | 1                       |
| 3954 967    |           | 000                     | 3962 320      |           | 2                       |
| 3955 157    |           | 000 N                   | 3962 489      | Fe?       | 2                       |
| 3955 356    |           | 1                       | 3962 534      |           | 0                       |
| 3955 482    | Fe        | 5                       | 3962 785      |           | 00                      |
| 3955 524    |           | 00                      | 3962 861      |           | 0                       |
| 3955 744    |           | 00                      | 3962 995      | Ti        | 3                       |
| 3955 903    |           | 0                       | 3963 108      |           | 00                      |
| 3955 968    |           | 000                     | 3963 252      | Fe        | 3                       |
| 3956 099    | Fe        | 3                       | 3963 369      |           | 1                       |
| 3956 197    |           | 00                      | 3963 487      |           | 00                      |
| 3956 316    |           | 00                      | 3963 576      |           | 1                       |
| 3956 476    | Co-Ti     | 4                       | 3963 701      |           | 00                      |
| 3956 603    | Fe        | 4                       | 3963 831      | Cr        | 3                       |
| 3956 819    | Fe        | 6                       | 3963 941      |           | 000                     |
| 3957 030    |           | 00                      | 3964 059      |           | 00                      |
| 3957 177 s  | Fe-Ca     | 7 d?                    | 3964 173      |           | 0                       |
| 3957 423    |           | 00                      | 3964 326      |           | 1                       |
| 3957 621    |           | 00 N                    | 3964 416      | Li        | 2                       |
| 3957 767    | Fe, Co    | 1                       | 3964 541      |           | 00                      |
| 3957 939    |           | 00                      | 3964 663      | Fe        | 3                       |
| 3958 073    | Co        | 2                       | 3964 897      | Fe?       | 0 N d?                  |
| 3958 231    |           | 00                      | 3965 148      | Co,       | 0 N                     |
| 3958 355    | Ti, Zr    | 5                       | 3965 366      | Co        | 0                       |
| 3958 474    |           | 000                     | 3965 487      |           | 000                     |
| 3958 554    | Fe?       | 0                       | 3965 614      |           | 000                     |
| 3958 647    |           | 000                     | 3965 655      | Fe,-      | 2                       |
| 3958 776    |           | 00                      | 3965 750      |           | 0                       |
| 3958 877    | Fe        | 1                       | 3965 868      |           | 1                       |
| 3959 006    |           | 000                     | 3965 980      |           | 1                       |
| 3959 102    |           | 00                      | 3966 069      |           | 2                       |
| 3959 335    |           | 00                      | 3966 212      | Fe        | 3                       |
| 3959 435    |           | 0                       | 3966 494      | Fe        | 0 N                     |
| 3959 588    |           | 00                      | 3966 647      | Ni, Fe    | 2                       |
| 3959 678    |           | 00                      | 3966 778      | Fe        | 3                       |
| 3959 862    |           | 000                     | 3966 966      | Fe        | 1                       |
| 3959 972    |           | 1                       | 3967 194      |           | 0 N d?                  |
| 3960 288    |           | 00                      | 3967 570      | Fe        | 2                       |
| 3960 422 s  | Fe        | 4                       | 3967 777      |           | 0 N                     |
| 3960 547    |           | 000                     | 3968 000      |           | 0 N                     |
| 3960 783    |           | 00                      | 3968 114      | Fe        | 1                       |
| 3960 902    | Cl        | 00                      | 3968 350      |           | 6 N                     |
| 3961 051    |           | 00                      | 3968 625 s II | Ca        | 700                     |
| 3961 148    | Co        | 0                       | 3968 854      | Fe?       | 1 N                     |

| Wave length  | Substance | Intensity and Character | Wave length | Substance                      | Intensity and Character |
|--------------|-----------|-------------------------|-------------|--------------------------------|-------------------------|
| 3968 886     |           | 6 N                     | 3975 197    |                                | oo Nd?                  |
| 3969 073     |           | o N                     | 3975 350    | Fe                             | 2                       |
| 3969 287     | Cr, Co    | o N                     | 3975 506    | Co-                            | 1                       |
| 3969 413     | Fe        | 10                      | 3975 662    |                                | oo Nd?                  |
| 3969 544     |           | o N                     | 3975 831    |                                | oo Nd?                  |
| 3969 642     |           | o N                     | 3975 985    | Fe-Mn                          | 2                       |
| 3969 784     | Fe        |                         | 3976 097    |                                | ooo                     |
| 3969 899     | Cr        | 2                       | 3976 230    |                                | 2                       |
| 3970 065     | Fe?       | o N                     | 3976 325    |                                | ooo                     |
| 3970 177     | II?       | 5 N                     | 3976 416    |                                | oo                      |
| 3970 305     |           | o N                     | 3976 532    | Fe                             | 2                       |
| 3970 419     |           | 1                       | 3976 692    | Fe                             | 2                       |
| 3970 540     |           | 2                       | 3976 770    | Fe                             | 3                       |
| 3970 631     |           | 1                       | 3976 839    | Cr                             | 3                       |
| 3970 711     |           | ooo                     | 3977 009    | Fe                             | 2                       |
| 3970 803     |           | o                       | 3977 126    |                                | o                       |
| 3970 979     |           | o                       | 3977 223    | Mn                             | oo                      |
| 3971 147     |           | 1 N                     | 3977 337    | Co                             | o                       |
| 3971 265     |           | ooo                     | 3977 477    |                                | ooo                     |
| 3971 402     | Cl        | o                       | 3977 716    |                                | oo N                    |
| 3971 475 s   | Fe        | 5                       | 3977 891 s  | Fe                             | 6                       |
| 3971 608     |           | ooo                     | 3978 036    |                                | ooo                     |
| 3971 751     |           | ooo                     | 3978 161    |                                | oo                      |
| 3971 863     |           | oo                      | 3978 306    |                                | o                       |
| 3971 969     | Fe?       | o                       | 3978 485    |                                | 1                       |
| 3972 134     |           | o N d?                  | 3978 604    | Fe                             | 2                       |
| 3972 313     | Ni        | 2                       | 3978 715    |                                | oo                      |
| 3972 407     |           | 1                       | 3978 809    | Co, Cr                         | 3                       |
| 3972 558     |           | 1                       | 3978 916    |                                | ooo                     |
| 3972 598     | Co        | o                       | 3979 003    | Co?                            | o                       |
| 3972 720     |           | 1                       | 3979 152    |                                | ooo                     |
| 3972 830     | Cr?       | oo                      | 3979 256    |                                | oo                      |
| 3973 056     | Fe        | 1                       | 3979 344    |                                | oo                      |
| 3973 152     |           | oo                      | 3979 466    |                                | oo                      |
| 3973 262     | Co        | 1                       | 3979 664    | Co                             | 4                       |
| 3973 308     | Co        | 1                       | 3979 783    | Fe                             | 3                       |
| 3973 418     | Fe?       | o                       | 3979 936    | Fe, Cl                         | o                       |
| 3973 558     |           | oo N                    | 3980 043    |                                | oo                      |
| 3973 702     | Ni, Z1    | 3                       | 3980 153    |                                | 1                       |
| 3973 796 } s | Fe        | 1                       | 3980 289    |                                | oo                      |
| 3973 864 }   | Ca        | 2                       | 3980 441    |                                | oo                      |
| 3974 004     | Fe?       | o                       | 3980 664    |                                | oo                      |
| 3974 057     |           | 1                       | 3980 779    | Fe                             | 1                       |
| 3974 164     |           | ooo                     | 3980 963    | not Fe part. in H <sub>2</sub> | ooo                     |
| 3974 310     |           | 1                       | 3981 024    |                                | oo                      |
| 3974 408     |           | oo                      | 3981 122    | Ce                             | 1                       |
| 3974 536     | Fe        | 3                       | 3981 248    | Fe                             | 2                       |
| 3974 637     | Ni?       | 2                       | 3981 376    | Cl                             | 1                       |
| 3974 774     | Ni        | 2                       | 3981 467    |                                | ooo                     |
| 3974 904     | Co Fe     | 6 d?                    | 3981 592    |                                | ooo                     |

\* The Hydrogen line must be wide and diffuse, and thus probably coincides with this solar line which is of that nature.

| Wave length    | Substance | Intensity and Character | Wave length | Substance      | Intensity and Character          |
|----------------|-----------|-------------------------|-------------|----------------|----------------------------------|
| 3981 662       |           | 00                      | 3988 617    |                |                                  |
| 3981 762       | Zr?       | 0                       | 3988 659    | La             | { 0<br>0<br>0<br>00 N<br>00 N d? |
| 3981 917 s     | Ti Fe     | 4                       | 3988 705    |                |                                  |
| 3982 142       | Fe?       | 2                       | 3988 812    |                |                                  |
| 3982 308       |           | 00 N                    | 3988 979    |                |                                  |
| 3982 470       |           | 00 N                    | 3989 137    |                |                                  |
| 3982 630       | Ti Mn     | 2                       | 3989 232    |                | 3                                |
| 3982 742       | Y         | 3                       | 3989 404    |                | 2                                |
| 3982 896       |           | 000                     | 3989 592    |                | 00 N                             |
| 3983 053       | Mn        | 00                      | 3989 753    |                | 00 N                             |
| 3983 150       |           | 2 N                     | 3989 912    |                | 00 N                             |
| 3983 341       |           | 2 N                     | 3990 011    | Γ <sub>1</sub> | 4                                |
| 3983 503       |           | 0                       | 3990 129    | Fe             | 3                                |
| 3983 682       |           | 1                       | 3990 248    | Cr-Mn          | 1                                |
| 3983 811       |           | 00                      | 3990 333    |                | 0                                |
| 3983 959       |           | 0                       | 3990 445    | Co             | 00                               |
| 3984 059       | Cr        | { 3<br>4<br>2           | 3990 525    | Fe             | 0                                |
| (3984 091) } s |           |                         | 3990 712    | V              | 2                                |
| 3984 113       |           |                         | 3990 905    |                | 0 N d?                           |
| 3984 294       | Fe        | 4                       | 3991 095    |                | 000 N                            |
| 3984 479       | Mn        | 2                       | 3991 333    | Cr, Zr         | 00 N d?                          |
| 3984 592       | Cr        | 2                       | 3991 459    |                | 3                                |
| 3984 707       |           | 00                      | 3991 580    |                | 00 N                             |
| 3984 806       | Ce-Zr     | 000                     | 3991 690    | Fe             | 1                                |
| 3984 982       |           | 2                       | 3991 830    | Co             | 0                                |
| 3985 084       |           | 00                      | 3991 892    | Co-Cr          | 2                                |
| 3985 213       |           | 1                       | 3991 981    |                | 0                                |
| 3985 385       |           | 000                     | 3992 041    |                | 00                               |
| 3985 463       | Mn        | 0                       | 3992 164    |                | 00                               |
| 3985 539       | Fe        | 1                       | 3992 261    |                | 000                              |
| 3985 745       |           | 5                       | 3992 396    |                | 00                               |
| 3985 773       |           | 00                      | 3992 538    | Fe             | 2                                |
| 3985 939       |           | 00                      | 3992 631    |                | 1                                |
| 3986 147       |           | 00 N d?                 | 3992 790    |                | 00                               |
| 3986 321       | Fe        | 00 N                    | 3992 971    | V-Cr           | 0                                |
| 3986 439       |           | 3                       | 3993 121    |                | 3 d?                             |
| 3986 513       |           | 0                       | 3993 246    | Fe             | 00                               |
| 3986 717       |           | 000                     | 3993 451    |                | 2                                |
| 3986 903 s     |           | 000                     | 3993 616    | Ba?            | 00 N                             |
| 3986 979       | Mn        | 6                       | 3993 758    |                | 00 N                             |
| 3987 140       |           | 1                       | 3993 878    |                | 0                                |
| 3987 244 } s   | -Mn       | 3                       | 3993 978    |                | 0                                |
| 3987 332       | Co        | 1                       | 3994 092    | Cr             | 00                               |
| 3987 520       |           | 0                       | 3994 160    |                | 1                                |
| 3987 625       | Mn?       | 0                       | 3994 265    |                | 1                                |
| 3987 755       | Ti?       | 0                       | 3994 416    | Fe             | 4                                |
| 3987 885       |           | 2                       | 3994 474    |                | 000                              |
| 3988 114       |           | 000                     | 3994 612    |                | 000                              |
| 3988 259       |           | 0                       | 3994 660    | Zr Co          | 00                               |
| 3988 485       |           | 000 N                   | 3994 828    |                | 2 N                              |
|                |           | 00 N                    |             | Nd?            | 2                                |

\* The Lanthanum line is a compound line made up of two or three lines covering about the width of these three lines of the spectrum



| Wave length | Substance       | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------------|-------------------------|-------------|-----------|-------------------------|
| 3994 958    | Ti              | 00                      | 4001 387    | Mn        | 000                     |
| 3995 096    |                 | 00                      | 4001 489    |           | 000                     |
| 3995 217    |                 | 00                      | 4001 595    | Cr        | I                       |
| 3995 352    |                 | 2                       | 4001 704    |           | 00                      |
| 3995 463    | Co              | 5                       | 4001 814    | Fe        | 3                       |
| 3995 586    |                 | 00                      | 4001 895    |           | 00                      |
| 3995 769    | Ba <sup>p</sup> | 000                     | 4002 086    | Mn        | 00 N d?                 |
| 3995 899    | La              | I N d?                  | 4002 227    |           | 0                       |
| 3996 009    |                 | 00                      | 4002 308    | Mn        | 00                      |
| 3996 140    | Fe              | 3                       | 4002 547    |           | 00                      |
| 3996 264    |                 | 0                       | 4002 652    | Fe-Ti     | 0 d                     |
| 3996 410    |                 | I                       | 4002 808    |           | 0                       |
| 3996 498    |                 | 00                      | 4002 948    |           | 00                      |
| 3996 682    | Sc              | 00                      | 4003 076    |           | 2                       |
| 3996 752    |                 | 00                      | 4003 230    |           | 000                     |
| 3996 845    |                 | 00                      | 4003 424    |           | 00 N                    |
| 3996 935    |                 | 0                       | 4003 655    |           | 00 N                    |
| 3997 004    |                 | 000                     | 4003 772    |           | 00 N                    |
| 3997 115    | Fe              | 2                       | 4003 912 s  | Ce Fe-Ti  | 3                       |
| 3997 258    | Cl <sup>p</sup> | I                       | 4004 062    |           | 00                      |
| 3997 365    | Mn              | 000                     | 4004 168    |           | 0                       |
| 3997 547    | Fe              | 4                       | 4004 308    |           | 00                      |
| 3997 638    |                 | 2                       | 4004 412    |           | 000                     |
| 3997 757    |                 | 000                     | 4004 536    |           | 00                      |
| 3997 895    |                 | 00 N                    | 4004 753    |           | 00                      |
| 3998 053    | Co              | 4 d?                    | 4004 855    |           | 000                     |
| 3998 205    | Fe              | 4                       | 4004 982    | Fe        | I                       |
| 3998 417    |                 | 000                     | 4005 067    |           | I                       |
| 3998 620    |                 | 0                       | 4005 202    |           | I                       |
| 3998 790    | Ti              | 4                       | 4005 216    |           | I                       |
| 3998 893    |                 | 000                     | 4005 308    |           | 0 N                     |
| 3998 999    |                 | 000                     | 4005 408    | Fe        | 7                       |
| 3999 117    | Zn, Fe          | I                       | 4005 545    |           | I                       |
| 3999 197    | Ce              | 0                       | 4005 632    |           | I                       |
| 3999 295    |                 | 000                     | 4005 802    |           | 000                     |
| 3999 393    |                 | 0                       | 4005 856    |           | 3                       |
| 3999 495    | Fe <sup>p</sup> | 00                      | 4005 994    |           | 000                     |
| 3999 646    |                 | 000                     | 4006 114    | Ti        | 0                       |
| 3999 818    | Cr <sup>p</sup> | 00                      | 4006 168    |           | 00                      |
| 3999 943    |                 | 000                     | 4006 304    | Ni        | I                       |
| 4000 173    | Fe <sup>p</sup> | 0                       | 4006 464    | Fe        | 2                       |
| 4000 296    |                 | 000                     | 4006 621    |           | 00                      |
| 4000 403    | Fe              | 2                       | 4006 776    | Fe        | 3                       |
| 4000 521    |                 | 0                       | 4006 901    |           | 2                       |
| 4000 611    | Fe              | 2                       | 4006 978    |           | I                       |
| 4000 729    |                 | 00                      | 4007 142    |           | I                       |
| 4000 965    |                 | 0                       | 4007 185    | Mn        | 00                      |
| 4001 119    |                 | 000                     | 4007 310    |           | 000                     |
| 4001 256    |                 | 0                       | 4007 429    | Fe        | 3                       |
| 4001 315    |                 | 3                       | 4007 586    |           | 00                      |

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 4007 758    | Fe        | 00 N d?                 | 4014 117    | Co        | 00 N                    |
| 4007 948    |           | 00                      | 4014 274    |           | 00 N                    |
| 4008 075    | Co-?      | 0 N                     | 4014 420    | Fe        | 1                       |
| 4008 215    | Mn Ti     | 0                       | 4014 537    |           | 00                      |
| 4008 322    |           | 0                       | 4014 677    | Fe        | 5 d?                    |
| 4008 507    |           | 000                     | 4014 827    |           | 00                      |
| 4008 568    |           | 000                     | 4014 941    |           | 000                     |
| 4008 748    |           | 0                       | 4015 086    | Ce        | 0 N d?                  |
| 4008 882    |           | 00                      | 4015 305    |           | 0                       |
| 4009 022    |           | 2                       | 4015 416    |           | 000                     |
| 4009 079    | Ti        | 3                       | 4015 532    |           | 0                       |
| 4009 201    |           | 000                     | 4015 628    | Ti?       | 0                       |
| 4009 291    |           | 1                       | 4015 760    |           | 3                       |
| 4009 401    |           | 000                     | 4015 880    |           | 00                      |
| 4009 567    |           | 000                     | 4016 027    |           | 00                      |
| 4009 694    | Fe        | 1                       | 4016 154    |           | 00                      |
| 4009 807    | Ti        | 1                       | 4016 240    |           | 000                     |
| 4009 864    | Fe        | 3                       | 4016 434    |           | 0                       |
| 4010 057    |           | 000                     | 4016 574 s  | Fe        | 2                       |
| 4010 134    | Ni        | 00                      | 4016 695    | Fe        | 00                      |
| 4010 201    |           | 000                     | 4016 835    |           | 00                      |
| 4010 327    | Fe        | 1                       | 4016 955    | Co Cr     | 0                       |
| 4010 434    |           | 000                     | 4017 114    |           | 00                      |
| 4010 527    |           | 00                      | 4017 244    |           | 3                       |
| 4010 641    |           | 000                     | 4017 308    | Fe        | 4                       |
| 4010 735    |           | 3                       | 4017 458    |           | 000                     |
| 4010 797    |           | 000                     | 4017 620    | Ni?       | 2                       |
| 4010 927    | Fe        | 2                       | 4017 724    | Ni?       | 1                       |
| 4011 080    | Fe        | 2                       | 4017 925    | Ti        | 0                       |
| 4011 221    |           | 00                      | 4018 080    |           | 00                      |
| 4011 451    |           | 00                      | 4018 234    | Mn        | * { 3                   |
| 4011 561    | Fe        | 3                       | 4018 269    | Mn        | { 4                     |
| 4011 693    | Mn        | 00                      | 4018 420    | Fe        | 3                       |
| 4011 865    | Fe        | 2                       | 4018 534    |           | 00                      |
| 4012 046    |           | 00                      | 4018 646    |           | 00                      |
| 4012 174    |           | 00                      | 4018 840    |           | 000                     |
| 4012 305    | Fe        | 0                       | 4018 996    |           | 00                      |
| 4012 399    | Nd, Zr    | 1                       | 4019 087    |           | 00                      |
| 4012 541    | Ti        | 4                       | 4019 201    | Ni Ce     | 1                       |
| 4012 631    | Cr        | 0                       | 4019 287    |           | 00                      |
| 4012 757    |           | 00 N d?                 | 4019 450    | Co        | 0                       |
| 4012 858    |           | 00                      | 4019 580    |           | 000                     |
| 4012 941    |           | 00                      | 4019 747    |           | 00 N                    |
| 4013 107    |           | 00                      | 4019 987    |           | 000                     |
| 4013 221    |           | 00                      | 4020 034    | Fe        | 000                     |
| 4013 387    |           | 0                       | 4020 171    |           | 0                       |
| 4013 614    |           | 000                     | 4020 226    | Mn        | 1                       |
| 4013 729    |           | 0                       | 4020 341    |           | 1                       |
| 4013 798    | Ti-Fe     | 3                       | 4020 424    |           | 2                       |
| 4013 964    | Fe        | 5                       | 4020 547    | Sc        | 1                       |

\* Probably compound lines, of which there are many in the spectrum of Manganese

| Wave length | Substance | Intensity and Character | Wave-length  | Substance | Intensity and Character |
|-------------|-----------|-------------------------|--------------|-----------|-------------------------|
| 4020 639    | Fe        | 1                       | 4027 539     |           | 0                       |
| 4020 799    |           | 000                     | 4027 623     |           | 00                      |
| 4020 927    |           | 000                     | 4027 822     |           | 1                       |
| 4021 057    | Co        | 3                       | 4027 939     |           | 00                      |
| 4021 238    |           | 000                     | 4028 092     |           | 0                       |
| 4021 346    |           | 000                     | 4028 272     |           | 000                     |
| 4021 493    | Nd        | 0                       | 4028 497     | Ti        | 4                       |
| 4021 645    |           | 000                     | 4028 638     |           | 00                      |
| 4021 769    | Fe        | 2                       | 4028 756     |           | 00                      |
| 4021 893    | li        | 0                       | 4028 912     | Fe-Ce     | 1                       |
| 4022 018    | Fe        | 5                       | 4029 138     | Zr        | 000                     |
| 4022 199    |           | 0 N                     | 4029 319     |           | 000                     |
| 4022 371    | Fe        | 1                       | 4029 445     |           | 0 N                     |
| 4022 401    | Cr        | 0                       | 4029 597     |           | 5                       |
| 4022 599    | Fe        | 0                       | 4029 796 s   | Fe-Zr     | 00 N                    |
| 4022 685    | Cu?       | 000                     | 4030 026     |           | 00 N                    |
| 4022 775    |           | 00                      | 4030 198     | Zr        | 00 N                    |
| 4022 893    | Fe        | 2                       | 4030 339     | Fe        | 2                       |
| 4023 165    | Nd        | 0                       | 4030 497     | Sr        | 0                       |
| 4023 379    |           | 00 N                    | 4030 646     | Fe-Ti     | 5                       |
| 4023 533    | Co-       | 3                       | 4030 796     |           | 0                       |
| 4023 705    | La        | 000                     | 4030 878     | Mn        | 4                       |
| 4023 834    | Sc        | 2                       | (4030 918) s |           | 5                       |
| 4023 979    | Fe        | 000                     | 4030 947     | Mn        | 2                       |
| 4024 153    | Zr        | 1                       | 4031 048     |           | 0                       |
| 4024 247    | Fe        | 2                       | 4031 270     | Fe        | 1                       |
| 4024 373    |           | 000                     | 4031 395     |           | 0                       |
| 4024 479    |           | 000                     | 4031 492     |           | 00                      |
| 4024 593    |           | 00                      | 4031 596     |           | 00                      |
| 4024 726    | li        | 3                       | 4031 712     | Fe La     | 2                       |
| 4024 881    | Fe        | 4                       | 4031 865     | Mn        | 2                       |
| 4025 043    |           | 000 N                   | 4031 942     | Fe        | 2                       |
| 4025 158    | Cr        | 0                       | 4032 117     |           | 00                      |
| 4025 286    | li-       | 3                       | 4032 265     |           | 00                      |
| 4025 458    |           | 000                     | 4032 418     |           | 00                      |
| 4025 579    | Cr        | 1                       | 4032 610     | Fe        | 2                       |
| 4025 733    |           | 000                     | 4032 789     | Fe        | 4                       |
| 4025 826    |           | 000                     | 4032 985     |           | 000                     |
| 4025 972    | Co La     | 2                       | 4033 112     |           | 00                      |
| 4026 079    |           | 00                      | 4033 224 s   | Fe-Mn     | 17 d?                   |
| 4026 220    |           | 00                      | 4033 337     |           | 1                       |
| 4026 318    | Cl        | 0                       | 4033 425     |           | 00                      |
| 4026 461    |           | 00                      | 4033 578     |           | 000 d?                  |
| 4026 583    | Mn        | 12 N                    | 4033 732     | Mn        | 1                       |
| 4026 691    | li        | 1                       | 4033 814     | Mn        | 1                       |
| 4026 919    |           | 00                      | 4033 946     |           | 00                      |
| 4027 067    |           | 00                      | 4034 052     |           | 00                      |
| 4027 189    | Co        | 1                       | 4034 120     |           | 00                      |
| 4027 253    | Cl        | 0                       | 4034 245     |           | 00                      |
| 4027 399    | Zi        | 00                      | 4034 380     |           | 1 N                     |

\* Probably compound lines, of which there are many in the spectrum of Manganese

| Wave length | Substance  | Intensity and Character | Wave length       | Substance      | Intensity and Character |     |
|-------------|------------|-------------------------|-------------------|----------------|-------------------------|-----|
| 4034 533    | Mn Fe      | I                       | 4042 064          | Cr, Nd         | 00                      |     |
| 4034 644 s  |            | <sup>16</sup> d?        | 4042 137          |                | 000                     |     |
| 4034 880    |            | 00                      | 4042 297          |                | 000                     |     |
| 4035 018    |            | 00 Nd?                  | 4042 397          |                | 00                      |     |
| 4035 265    |            | 00 N                    | 4042 511          |                | 000                     |     |
| 4035 399    |            | 0                       | 4042 591          |                | 000                     |     |
| 4035 575    |            | 00                      | 4042 743          |                | 0                       |     |
| 4035 695    |            | 0                       | 4042 909          |                | 00                      |     |
| 4035 752    |            | 2                       | 4043 054          |                | 0                       |     |
| 4035 883 s  |            | Co                      | 4043 145          |                | 000                     |     |
| 4035 976    |            | Mn                      | 4043 500          |                | 0 N                     |     |
| 4036 131    |            | Ti, Zr                  | 0                 |                | 4043 757                | 00  |
| 4036 251    |            |                         | 000               |                | 4043 839                | 0   |
| 4036 293    |            |                         | 00                |                | 4043 956                | 0   |
| 4036 522    |            |                         | 0                 |                | 4044 056                | Cr  |
| 4036 717    |            | 00                      | 4044 141          | Fe             |                         |     |
| 4036 813    |            | 000                     | 4044 294 s        | K              |                         |     |
| 4036 923    |            | I                       | 4044 423          | 0              |                         |     |
| 4037 076    |            | 00 Nd?                  | 4044 531          | 000            |                         |     |
| 4037 268    | Cr         | 2                       | 4044 644          | 00             |                         |     |
| 4037 449    |            | 00                      | 4044 766          | I              |                         |     |
| 4037 585    |            | 000                     | 4044 992          | 3              |                         |     |
| 4037 691    |            | 00                      | 4045 108          | 000            |                         |     |
| 4037 837    |            | I                       | 4045 266          | 000            |                         |     |
| 4038 094    |            | 00 Nd?                  | 4045 371          | Mn<br>Mn<br>Co | { 2<br>1 N              |     |
| 4038 272    |            | 0                       | 4045 538          |                |                         | 5   |
| 4038 425    |            | 0                       | 4045 662          |                |                         | 0   |
| 4038 627    |            | 00 Nd?                  | 4045 748          |                |                         | 2   |
| 4038 771    |            | I                       | 4045 864          |                |                         | 0   |
| 4038 944    |            | 2                       | 4045 975 s        |                |                         | 30  |
| 4039 094    |            | 00                      | 4046 117          |                |                         | I N |
| 4039 244    |            | Cr                      | 4046 230          | 2              |                         |     |
| 4039 444    |            |                         | 4046 490          | 00 N           |                         |     |
| 4039 580    |            |                         | 4046 612          | 0              |                         |     |
| 4039 727    |            | 4046 764                | 000               |                |                         |     |
| 4039 891    |            | 4046 917                | 0 N               |                |                         |     |
| 4040 013    | Y          | 4047 171                | 00 N              |                |                         |     |
| 4040 093    | Fe         | 4047 338                | 00 Nd?            |                |                         |     |
| 4040 243    | Fe?        | 4047 461                | 2                 |                |                         |     |
| 4040 411    |            | 4047 556                | 00                |                |                         |     |
| 4040 464    |            | 4047 823                | 0 N               |                |                         |     |
| 4040 657    |            | 4047 958                | 0 N               |                |                         |     |
| 4040 792    | Fe         | 4048 224                | I N               |                |                         |     |
| 4040 937    | Ce, Nd, Co | 4048 384                | 00                |                |                         |     |
| 4041 099    |            | 4048 549                | 00 N              |                |                         |     |
| 4041 221    |            | 4048 704                | 00                |                |                         |     |
| 4041 431    | Fe         | 4048 818                | Zn<br>Mn Cr<br>Mn | { I<br>5<br>0  |                         |     |
| 4041 525    | Mn         | (4048 883) s            |                   |                |                         |     |
| 4041 803    | Zr-        | 4048 910                |                   |                |                         |     |
| 4041 957    |            | 4049 148                |                   |                |                         |     |

\*Probably compound lines, of which there are many in the spectrum of Manganese

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 4049 303    |           | 0                       | 4056 007    |           | 000                     |
| 4049 363    |           | 000                     | 4056 135    | Fe        | 0                       |
| 4049 482    | Fe        | 2                       | 4056 221    | Cr        | 0                       |
| 4049 590    |           | 00                      | 4056 345    |           | 0                       |
| 4049 716    |           | 1 N d?                  | 4056 495    | Fe        | 1                       |
| 4049 882    |           | 1 N d?                  | 4056 601    |           | 0                       |
| 4050 019    |           | 00                      | 4056 708    |           | 00                      |
| 4050 176    |           | 00                      | 4056 955    |           | 000 N                   |
| 4050 254    | La        | 000                     | 4057 055    |           | 00 N                    |
| 4050 482    | Zr        | 0                       | 4057 225    |           | 00                      |
| 4050 643    |           | 00                      | 4057 368    | Co        | 1 N                     |
| 4050 716    | Zr        | 00                      | 4057 499    | Fe        | 3                       |
| 4050 830    | Fe        | 2                       | 4057 668    |           | 7                       |
| 4050 963    |           | 000                     | 4057 817    |           | 0                       |
| 4051 095    |           | 00                      | 4057 881    |           | 000                     |
| 4051 204    | V         | 00 N                    | 4057 961    |           | 000                     |
| 4051 336    |           | 00 N d?                 | 4058 041    | Pb        | 0                       |
| 4051 491    | Cr-V      | 0 N d?                  | 4058 115    | Mn        | 0                       |
| 4051 742    |           | 000                     | 4058 372    | Co-Fe     | 4                       |
| 4051 888    | Mn        | 00 N d?                 | 4058 539    |           | 000                     |
| 4052 070    | Fe        | 3                       | 4058 615    |           | 00                      |
| 4052 176    |           | 0                       | 4058 748    | Ce        | 0                       |
| 4052 316    |           | 00                      | 4058 915    | Fe, Cr    | 3                       |
| 4052 454    | Fe        | 2                       | 4059 081    | Mn        | 3                       |
| 4052 603    | Mn        | 2                       | 4059 239    |           | 00                      |
| 4052 650    | Fe        | 3                       | 4059 373    |           | 0                       |
| 4052 812    | Fe        | 1                       | 4059 535    | Mn        | *1 N d?                 |
| 4052 871    |           | 1                       | 4059 653    |           | 0                       |
| 4052 992    |           | 000                     | 4059 768    |           | 000                     |
| 4053 091    | Co        | 0                       | 4059 872    | Fe        | 2                       |
| 4053 263    |           | 00                      | 4060 117    |           | 00                      |
| 4053 424    | Fe        | 2                       | 4060 248    |           | 00                      |
| 4053 582    |           | 0                       | 4060 415    | Ti        | 1                       |
| 4053 639    |           | 00                      | 4060 643    |           | 0                       |
| 4053 839    |           | 00                      | 4060 777    |           | 00                      |
| 4053 981    | Fe Ti     | 3                       | 4060 919    |           | 0                       |
| 4054 085    |           | 000                     | 4061 081    |           | 00                      |
| 4054 225    |           | 0                       | 4061 244    | Nd-       | 3                       |
| 4054 335    | Fe        | 1                       | 4061 450    |           | 000 N                   |
| 4054 457    |           | 000                     | 4061 595    |           | 0 N                     |
| 4054 591    | Zr        | 0                       | 4061 881    | Mn        | *2 N d                  |
| 4054 714    | Sc        | 00 N                    | 4062 105    |           | 2                       |
| 4054 863    |           | 0                       | 4062 197    |           | 00                      |
| 4054 962    |           | 2                       | 4062 385    |           | 00                      |
| 4055 023    | Fe        | 3                       | 4062 469    |           | 000                     |
| 4055 189    | Ti-Fe     | 3                       | 4062 599 s  | Fe        | 5                       |
| 4055 365    | Mn        | 00 N d?                 | 4062 789    | Cu?       | 0                       |
| 4055 533    |           | 00 N d?                 | 4062 895    |           | 00                      |
| 4055 701 s  | Mn ? Fe   | 6                       | 4063 105    |           | 00                      |
| 4055 855    |           | 00                      | 4063 260    |           | 00                      |

\*Probably compound lines, of which there are many in the spectrum of Manganese

| Wave length | Substance | Intensity and Character | Wave length | Substance  | Intensity and Character |
|-------------|-----------|-------------------------|-------------|------------|-------------------------|
| 4063 436    | Fe        | 4                       | 4071 137    |            | 00                      |
| 4063 573    | Mn        | 0                       | 4071 252    | Zr         | 0                       |
| 4063 759 s  | Fe        | 20                      | 4071 501    |            | 000                     |
| 4063 938    |           | 1 N d?                  | 4071 680    | Fe         | 1                       |
| 4064 075    |           | 0 N                     | 4071 780    |            | 0                       |
| 4064 201    |           | 1                       | 4071 908 s  | Fe         | 15                      |
| 4064 362    | Ti        | 1                       | 4072 059    |            | 0 N                     |
| 4064 515    | Ni        | 1                       | 4072 121    |            | 000                     |
| 4064 607    | Fe        | 2                       | 4072 295    |            | 00 N                    |
| 4064 728    |           | 00                      | 4072 508    |            | 0 N                     |
| 4064 913    | La        | 000                     | 4072 655    | Fe         | 2                       |
| 4065 239    | Mn-Ti     | 2 d?                    | 4072 853    | Zr         | 00                      |
| 4065 388    |           | 0                       | 4073 052    | Ce         | 00 Nd?                  |
| 4065 537    | Fe        | 3                       | 4073 287    |            | 0                       |
| 4065 737    |           | 0 N                     | 4073 493    |            | 000                     |
| 4065 861    | Cr        | 0                       | 4073 637    | Ce         | 0                       |
| 4065 960    |           | 000                     | 4073 780    |            | 000                     |
| 4066 155    |           | 00                      | 4073 921 s  | Fe         | 4                       |
| 4066 270    |           | 1                       | 4074 203    |            | 00                      |
| 4066 375    |           | 1                       | 4074 488    |            | 0 N                     |
| 4066 524    | Co        | 2                       | 4074 681    |            | 00                      |
| 4066 742    | Fe        | 2                       | 4074 835    |            | 2                       |
| 4066 870    |           | 0                       | 4074 947    | Fe         | 3                       |
| 4066 975    |           | 0                       | 4075 055    | Ni, Zr, Cr | 0                       |
| 4067 139    | Fe        | 5                       | 4075 257    | -Nd        | 2 N                     |
| 4067 429    | Fe        | 3                       | 4075 468    | Nd         | 0 N d?                  |
| 4067 558    | La        | 000                     | 4075 661    |            | 000                     |
| 4067 642    |           | 0                       | 4075 857    | Ce         | 0                       |
| 4067 753    |           | 0                       | 4075 995    | Ce         | 00                      |
| 4067 915    |           | 0                       | 4076 101    | Fe         | 3                       |
| 4068 005    |           | 00                      | 4076 201    | Cr         | 00                      |
| 4068 137    | Fe-Mn     | 6                       | 4076 283    |            | 00                      |
| 4068 268    |           | 000                     | 4076 375    | Fe-Ce      | 1                       |
| 4068 488    |           | 000                     | 4076 516    |            | 00                      |
| 4068 694    | Co        | 0                       | 4076 644    | Fe-Zr      | 2                       |
| 4068 801    |           | 000                     | 4076 792    | Fe         | 4                       |
| 4068 999    |           | 00                      | 4076 959    | Fe         | 2                       |
| 4069 115    |           | 000                     | 4077 033    |            | 1                       |
| 4069 221    |           | 2                       | 4077 221    | Cr         | 0 N                     |
| 4069 306    |           | 00                      | 4077 348    |            | 00                      |
| 4069 423    | Nd        | 0                       | 4077 498    | La, Y      | 1 N d?                  |
| 4069 588    |           | 00                      | 4077 630    |            | 0                       |
| 4069 761    |           | 1                       | 4077 731    |            | 0 N                     |
| 4069 890    |           | 000                     | 4077 885 s  | Sr         | 8                       |
| 4070 055    |           | 000                     | 4077 985    |            | 0 N                     |
| 4070 195    |           | 0                       | 4078 126    |            | 0                       |
| 4070 431    | Mn        | 3                       | 4078 318    |            | 00 Nd?                  |
| 4070 589    |           | 00 N                    | 4078 515    | Fe         | 4                       |
| 4070 777    |           | 00 N                    | 4078 631    | Ti         | 3                       |
| 4070 930    | Fe        | 4                       | 4078 801    |            | 000 Nd?                 |

\* Probably compound lines

# TABLE OF SOLAR SPECTRUM WAVE LENGTHS

31

| Wave length  | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|--------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 4078 977     | Fe        | 0                       | 4086 861    | Ia        | I                       |
| 4079 161     |           | 00 N d?                 | 4086 988    |           | 000                     |
| 4079 335     | Fe        | 2                       | 4087 115    |           | 000                     |
| 4079 393     | Mn        | 3                       | 4087 252    | Fe        | 3                       |
| 4079 508     |           | 000                     | 4087 425    |           | 00                      |
| 4079 570     | Mn        | 3                       | 4087 482    |           | 000                     |
| 4079 707     |           | 000                     | 4087 641    |           | 000                     |
| 4079 863     |           | 00                      | 4087 755    |           | 00                      |
| 4079 996     | Fe        | 3                       | 4087 855    |           | 000                     |
| 4080 209     |           | 00                      | 4087 949    |           | 00                      |
| 4080 368     | Fe, Nd    | 3                       | 4088 200    |           | 00                      |
| 4080 588     |           | 00                      | 4088 333    |           | 00                      |
| 4080 751     |           | 00                      | 4088 448    |           | 00                      |
| 4080 921     |           | 00                      | 4088 596    |           | 000                     |
| 4081 033     | Fe        | 2                       | 4088 713 s  | Fe        | 3                       |
| 4081 190     |           | 00                      | 4088 877    |           | 00                      |
| 4081 385     | Zr, Ce    | 0                       | 4089 000    |           | 00                      |
| 4081 415     | Fe        | 1                       | 4089 199    |           | 00 N                    |
| 4081 580     |           | 00 N                    | 4089 374    | Fe        | 3                       |
| 4081 736     |           | 00 N                    | 4089 568    |           | 000 N                   |
| 4081 887     |           | 00 N                    | 4089 748    |           | 000 N                   |
| 4082 060     |           | 000 N d?                | 4089 935    |           | 00 N                    |
| 4082 264     | Fe        | 2                       | 4090 113    | Mn        | 0 N d?                  |
| 4082 428     |           | 0 N d?                  | 4090 228    | Fe        | 2                       |
| 4082 589     | Sc-Fe-I1  | 3                       | 4090 338    |           | 000                     |
| 4082 749     | Co        | 0                       | 4090 474    | Cr        | 0 N                     |
| 4082 928     |           | 00 N d?                 | 4090 671    | Zr        | 0                       |
| 4083 095     | Mn        | 4                       | 4090 728    | V         | 1                       |
| 4083 243     |           | 000                     | 4090 921    | Zr        | 00 N d?                 |
| 4083 376     | Mn, Cu    | 0                       | 4091 109    |           | 3                       |
| 4083 515     |           | 000                     | 4091 235    |           | 000                     |
| 4083 715 } s | Fe        | { 2                     | 4091 588    |           | 000 N                   |
| 4083 783 } s | Mn, V     | { 4                     | 4091 711    | Fe        | 3                       |
| 4083 917 s   | Fe        | 1                       | 4091 828    |           | 000                     |
| 4084 148     |           | 0 N d?                  | 4092 149    |           | 00                      |
| 4084 476     |           | 0 N                     | 4092 248    |           | 00                      |
| 4084 647     | Fe        | 5                       | 4092 431    | Fe        | 2                       |
| 4084 761     |           | 000                     | 4092 547    | Co, Mn    | 3                       |
| 4084 944     |           | 000 N d?                | 4092 665    | Fe        | 1                       |
| 4085 161     | Fe        | 4                       | 4092 821    | *V, Ca?   | 3 d?                    |
| 4085 303     |           | 00                      | 4092 975    |           | 000                     |
| 4085 408     |           | 1                       | 4093 041    | Co        | 000                     |
| 4085 467     | Fe        | 4                       | 4093 185    | Co        | 00                      |
| 4085 595     |           | 000                     | 4093 435    |           | 00                      |
| 4085 727     |           | 00                      | 4093 801    |           | 00                      |
| 4085 881     |           | 00                      | 4094 141    |           | 00                      |
| 4086 008     |           | 00 N                    | 4094 220    |           | 000                     |
| 4086 133     |           | 1                       | 4094 455    |           | 00                      |
| 4086 283     |           | 0                       | 4094 573    |           | 2 N                     |
| 4086 469     | Co-       | 3 d?                    | 4094 761    |           | 000                     |

| Wave length         | Substance        | Intensity and Character | Wave length | Substance      | Intensity and Character |
|---------------------|------------------|-------------------------|-------------|----------------|-------------------------|
| 4094 849            |                  | 0 N                     | 4102 541    | Y              | 0                       |
| 4095 094            | <sup>1</sup> Ca? | 4                       | 4102 774    |                | 00 Nd?                  |
| 4095 251            |                  | 000                     | 4102 914    |                | 00 N                    |
| 4095 423            | Mn               | 0                       | 4103 097 s  | Si, Mn         | 5                       |
| 4095 511            |                  | 0                       | 4103 470    |                | 0                       |
| 4095 633            | V                | 0                       | 4103 621    |                | 00                      |
| 4095 795            |                  | 000                     | 4103 774    |                | 0 N                     |
| 4095 901            |                  | 000                     | 4103 967    |                | 00 N                    |
| 4095 968            |                  | 000                     | 4104 141    |                | 000                     |
| 4096 129            | Fe               | 3                       | 4104 288    | Fe             | 5                       |
| 4096 262            | Fe               | 2                       | 4104 459    |                | 00                      |
| 4096 367            |                  | 1                       | 4104 623    | Co, V          | 0                       |
| 4096 481            |                  | 000                     | 4104 807    |                | 000                     |
| 4096 675            |                  | 000                     | 4104 909    | Co, V          | 00                      |
| 4096 795            |                  | 00                      | 4105 099    |                | 00                      |
| 4096 848            | Zr?              | 0                       | 4105 216    |                | 1                       |
| 4096 976            |                  | 000                     | 4105 318    | V              | 00                      |
| 4097 101            |                  | 00                      | 4105 514    | Mn             | 2                       |
| 4097 168            |                  | 00                      | 4105 807    |                | 00 N                    |
| 4097 241            | Fe               | 3                       | 4105 879    |                | 000                     |
| 4097 389            |                  | 00                      | 4105 981    |                | 000                     |
| 4097 612            |                  | 000                     | 4106 294    |                | 000                     |
| 4097 733            |                  | 000                     | 4106 420    | Fe             | 000                     |
| 4097 808            |                  | 0                       | 4106 583    | Fe             | 2                       |
| 4097 948            |                  | 00                      | 4106 738    |                | 00                      |
| 4098 115            |                  | 0                       | 4106 887    |                | 0 N                     |
| 4098 335            | Fe               | 5                       | 4107 099    |                | 0                       |
| 4098 587            |                  | 000                     | 4107 449    |                | 00                      |
| 4098 689            | <sup>1</sup> Ca? | 4                       | 4107 649 s  | Ce Fe Zr       | 5                       |
| 4098 746            |                  | 2                       | 4107 815    |                | 000                     |
| 4098 947            |                  | 000                     | 4107 934    |                | 00                      |
| 4099 054            |                  | 000                     | 4108 041    |                | 00                      |
| 4099 207            |                  | 0                       | 4108 181    |                | 00                      |
| 4099 327            | Ti               | 00                      | 4108 289    |                | 1                       |
| 4099 554            |                  | 000                     | 4108 454    |                | 000                     |
| 4099 727            | La               | 000                     | 4108 547    | Zr             | 00                      |
| 4099 941            | V                | 2                       | 4108 687    |                | 2                       |
| 4100 147            |                  | 0                       | 4109 062    |                | 0                       |
| 4100 315            | Fe               | 2                       | 4109 215    | Fe             | 3                       |
| 4100 501            |                  | 0                       | 4109 374    |                | 000                     |
| 4100 661            |                  | 000                     | 4109 609    | Nd?            | 1                       |
| 4100 731            |                  | 000                     | 4109 734    | Cr             | 0                       |
| 4100 901            | Fe               | 4                       | 4109 905    | <sup>1</sup> V | 2                       |
| 4101 067            |                  | 0                       | 4109 953    | Fe             | 3                       |
| 4101 244            |                  | 0                       | 4110 114    |                | 000                     |
| 4101 421            | Fe               | 2                       | 4110 194    |                | 00                      |
| 4101 637            |                  | 0                       | 4110 454    |                | 00                      |
| 4101 840            |                  | 3                       | 4110 547    |                | 00                      |
| 4102 000 H $\delta$ | H, In            | 40 N                    | 4110 691    | Co             | 00                      |
| 4102 321            | V                | 0                       | 4110 854    |                | 4                       |
|                     |                  |                         |             |                | 000                     |

\* These lines coincide with the heads of bands due to Calcium. The bands probably become lines owing to the weak dilution of Calcium vapor in the Sun.



| Wave length | Substance      | Intensity and Character | Wave length | Substance       | Intensity and Character |
|-------------|----------------|-------------------------|-------------|-----------------|-------------------------|
| 4111 021    | Mn             | I                       | 4118 148    |                 | 00                      |
| 4111 154    | Mn?            | I                       | 4118 307    | V               | 0                       |
| 4111 355    |                | 000                     | 4118 347    |                 | 000                     |
| 4111 509    | Ce?            | I                       | 4118 581    |                 | 000                     |
| 4111 742    |                | 000                     | 4118 708    | Fe              | 5                       |
| 4111 827    |                | 00                      | 4118 934    | Co              | 4                       |
| 4111 940    | <sup>2</sup> V | 4                       | 4119 050    | Fe              | 2                       |
| 4112 139    |                | 000                     | 4119 207    |                 | 000 N                   |
| 4112 234    |                | 00                      | 4119 411    |                 | 00 N                    |
| 4112 327    |                | 000                     | 4119 550    | Fe              | I                       |
| 4112 478    | Fe             | 2                       | 4119 679    |                 | 0                       |
| 4112 603    |                | 000                     | 4119 823    |                 | 0                       |
| 4112 721    |                | 00 N d?                 | 4119 950    |                 | 0                       |
| 4112 869    | Ti             | I                       | 4120 075    |                 | 0                       |
| 4112 959    |                | 000                     | 4120 202    |                 | 000                     |
| 4113 067    |                | I                       | 4120 368    | Fe              | 4                       |
| 4113 117    | Fe             | 3                       | 4120 625    |                 | 000                     |
| 4113 247    |                | 00                      | 4120 775    |                 | 0                       |
| 4113 381    | Mn             | I                       | 4120 926    |                 | 000                     |
| 4113 679    |                | 000 N d?                | 4120 995    |                 | 00                      |
| 4113 839    |                | 00 N d                  | 4121 308    |                 | 00                      |
| 4114 021    | Mn             | 00 N d?                 | 4121 477 s  | Cr-Co           | 6 d?                    |
| 4114 271    |                | 00 d                    | 4121 648    | Zi              | 00 N                    |
| 4114 461    | Mn             | 000                     | 4121 805    |                 | 00 N                    |
| 4114 606 s  | Fe             | 4                       | 4121 963 s  | Fe, Cr          | 3                       |
| 4114 771    |                | 00 N                    | 4122 142    |                 | 00                      |
| 4114 934    |                | 00 N                    | 4122 306    | Ti, Cr          | I                       |
| 4115 094    |                | 2                       | 4122 396    |                 | 000                     |
| 4115 189    |                | 000                     | 4122 511    |                 | 00 N                    |
| 4115 330    | <sup>2</sup> V | 3                       | 4122 673    | Fe              | 3                       |
| 4115 533    |                | 00 N                    | 4122 819    |                 | I                       |
| 4115 715    |                | 000                     | 4122 936    |                 | 00q                     |
| 4115 834    |                | 000                     | 4123 027    |                 | 000                     |
| 4115 961    |                | 000                     | 4123 184    |                 | 00 N                    |
| 4116 047    |                | 00                      | 4123 384    | <sup>2</sup> La | 12                      |
| 4116 138    |                | 0                       | 4123 430    |                 | 00                      |
| 4116 276    |                | 000                     | 4123 539    | V               | 0                       |
| 4116 361    |                | 000                     | 4123 664    | Mn              | I                       |
| 4116 474    |                | 00                      | 4123 713    | Ti              | 000                     |
| 4116 634    | <sup>2</sup> V | I                       | 4123 907    | Fe              | 5                       |
| 4116 707    | <sup>2</sup> V | 0                       | 4124 030    | Ce?             | 00                      |
| 4116 859    | Nd?            | I                       | 4124 097    |                 | 00                      |
| 4116 974    |                | 00                      | 4124 260    |                 | 000                     |
| 4117 113    |                | 0                       | 4124 359    |                 | 000                     |
| 4117 317    |                | 000                     | 4124 510    |                 | 000                     |
| 4117 414    |                | 00                      | 4124 645    |                 | 0                       |
| 4117 587    |                | 000                     | 4124 782    |                 | 000                     |
| 4117 741    |                | 00                      | 4124 938    |                 | 0                       |
| 4117 894    |                | 000                     | 4125 067    |                 | 0                       |
| 4118 008    |                | 2                       | 4125 285    |                 | 000                     |

<sup>2</sup>These are some of the stronger Vanadium lines, and they are probably capable of producing the solar lines given in the table, especially 4111 940

<sup>2</sup>One of the strongest Lanthanum lines

# PRELIMINARY TABLE OF SOLAR SPECTRUM WAVE-LENGTHS III

By HENRY A ROWLAND

| Wave length | Substance | Intensity<br>and<br>Character | Wave length | Substance | Intensity<br>and<br>Character |
|-------------|-----------|-------------------------------|-------------|-----------|-------------------------------|
| 4125 384    |           | 000                           | 4130 804    | Ba        | 2                             |
| 4125 529    |           | 000                           | 4130 847    |           | 000                           |
| 4125 615    |           | 00                            | 4131 013    |           | 0 N d?                        |
| 4125 776    | Fe        | 3                             | 4131 151    |           | 000                           |
| 4125 850    |           | 1                             | 4131 271    | Mn        | 1                             |
| 4126 040    | Fe        | 3                             | 4131 419    |           | 000                           |
| 4126 200    | V         | 000                           | 4131 507    | Cr        | 0                             |
| 4126 344    | Fe        | 4                             | 4131 606    |           | 000                           |
| 4126 532    |           | 00                            | 4131 748    |           | 0000                          |
| 4126 673    | Cr        | 2                             | 4131 908    |           | 0                             |
| 4126 798    |           | 00                            | 4131 950    |           | 000                           |
| 4127 007    |           | 1                             | 4132 100    | V         | 2                             |
| 4127 070    | Cr        | 00                            | 4132 235    | Fe        | 10                            |
| 4127 225    |           | 00 N                          | 4132 435    |           | 0 N                           |
| 4127 426    | Cr        | 0                             | 4132 560    | Ba?       | 0                             |
| 4127 529    | Ce        | 00                            | 4132 690    |           | 3                             |
| 4127 689    | Tl        | 000                           | 4132 863    |           | 1                             |
| 4127 767    | Fe        | 4                             | 4133 062    | Fe        | 4                             |
| 4127 957    | Fe        | 4                             | 4133 284    |           | 000 N                         |
| 4128 093    |           | 00                            | 4133 441    |           | 000                           |
| 4128 251    | V-        | 6 d                           | 4133 510    |           | 00                            |
| 4128 461    |           | 00                            | 4133 625    |           | 00                            |
| 4128 543    |           | 00                            | 4133 755    | Fe        | 2                             |
| 4128 658    | Cr        | 000                           | 4133 873    |           | 0000                          |
| 4128 747    |           | 00                            | 4133 965    | Ce        | 0                             |
| 4128 894    |           | 2                             | 4134 010    | Fe        | 3                             |
| 4129 054    |           | 00 N                          | 4134 159    |           | 0 N                           |
| 4129 127    |           | 000 N                         | 4134 345    |           | 0                             |
| 4129 337    | Ce-       | 3                             | 4134 492    | Fe?       | 3                             |
| 4129 476    | Cr        | 00                            | 4134 589    | V-Fe?     | 3                             |
| 4129 616    |           | 2                             | 4134 675    |           | 1                             |
| 4129 657    |           | 000                           | 4134 840    | Fe        | 5                             |
| 4129 760    |           | 00                            | 4135 050    |           | 00 N                          |
| 4129 882    |           | 1                             | 4135 191    | Mn        | 0                             |
| 4130 112    |           | 0                             | 4135 325    |           | 0000                          |
| 4130 196    | Fe        | 2                             | 4135 447    |           | 0 d?                          |
| 4130 291    |           | 000                           | 4135 610    |           | 0 N d?                        |
| 4130 401    |           | 00                            | 4135 838    |           | 00                            |
| 4130 520    |           | 00                            | 4135 915    | Zr .      | 0                             |
| 4130 604    |           | 0                             | 4136 090    |           | 00 N                          |

| Wave length | Substance | Intensity and Character | Wave-length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 4136 245    |           | 0000                    | 4143 200    |           | 00                      |
| 4136 445    |           | 00                      | 4143 316    |           | 000                     |
| 4136 527    |           | 000                     | 4143 430    | Ti        | 000                     |
| 4136 678    | Fe        | 4                       | 4143 572    | Fe        | 4                       |
| 4136 890    |           | 00 N d?                 | 4143 664    |           | 2                       |
| 4137 033    |           | 000                     | 4143 782    |           | 0000                    |
| 4137 156    | Fe        | 6                       | 4143 903    |           | 00 N                    |
| 4137 272    |           | 0000                    | 4144 038    | Fe        | 15                      |
| 4137 428    | Ti, Mn    | 0 N d?                  | 4144 130    |           | 00 N                    |
| 4137 567    |           | 2                       | 4144 238    |           | 1                       |
| 4137 809    | Fe, Ce    | 1                       | 4144 353    |           | 00                      |
| 4137 925    |           | 00                      | 4144 402    |           | 00                      |
| 4138 038    |           | 00                      | 4144 538    |           | 00 N                    |
| 4138 134    |           | 0                       | 4144 674    | Ce?       | 0 N d?                  |
| 4138 288    |           | 00 N                    | 4144 824    |           | 0000                    |
| 4138 515    |           | 0 N                     | 4144 923    |           | 00                      |
| 4138 648    |           | 00                      | 4145 018    |           | 00                      |
| 4138 771    |           | 000                     | 4145 152    | Ce        | 0                       |
| 4138 909    |           | 000                     | 4145 242    |           | 0000                    |
| 4139 008    |           | 0                       | 4145 357    |           | 1                       |
| 4139 140    |           | 00                      | 4145 465    |           | 000                     |
| 4139 244    |           | 0                       | 4145 600    |           | 00                      |
| 4139 378    |           | 00                      | 4145 720    |           | 0 N                     |
| 4139 524    |           | 00                      | 4145 914    |           | 1 N                     |
| 4139 611    |           | 000                     | 4146 020    |           | 00                      |
| 4139 764    |           | 00                      | 4146 133    |           | 0                       |
| 4139 885    |           | 00                      | 4146 225    | Fe        | 3                       |
| 4140 089    | Fe        | 6                       | 4146 299    |           | 0                       |
| 4140 216    |           | 0000                    | 4146 544    |           | 00                      |
| 4140 316    |           | 000                     | 4146 655    |           | 00                      |
| 4140 400    | Fe?       | 0                       | 4146 845    |           | 0 N                     |
| 4140 558    |           | 3                       | 4146 997    |           | 00                      |
| 4140 611    |           | 00                      | 4147 145    |           | 2                       |
| 4140 910    |           | 0                       | 4147 369    |           | 00                      |
| 4140 985    |           | 00                      | 4147 502    |           | 2                       |
| 4141 096    |           | 000                     | 4147 645    | Mn        | 1                       |
| 4141 208    | Mn        | 0                       | 4147 677    |           | 000                     |
| 4141 405    | Fe        | 000 N                   | 4147 836    | Fe        | 4                       |
| 4141 690    |           | 0 N                     | 4148 021    |           | 000                     |
| 4141 809    | La        | 0                       | 4148 133    |           | 00 N                    |
| 4142 025    | Fe        | 4                       | 4148 330    |           | 00                      |
| 4142 180    |           | 00 N                    | 4148 416    |           | 00                      |
| 4142 330    | Cr, h     | 2                       | 4148 552    |           | 00                      |
| 4142 405    | Li        | 2                       | 4148 660    |           | 0                       |
| 4142 562    | Ce        | 00                      | 4148 776    |           | 00                      |
| 4142 629    | Cr, h     | 2                       | 4148 878    |           | 00                      |
| 4142 744    | 14        | 2                       | 4148 948    | Mn        | 0                       |
| 4142 923    |           | 0000                    | 4149 077    |           | 00                      |
| 4143 000    |           | 00                      | 4149 285    | C         | 0                       |
| 4143 103    |           | 0                       | 4149 360    | Zr        | 2                       |

| Wave-length | Substance | Intensity<br>and<br>Character | Wave length | Substance | Intensity<br>and<br>Character |
|-------------|-----------|-------------------------------|-------------|-----------|-------------------------------|
| 4149 533    | Fe        | 4                             | 4155 476    |           | 00                            |
| 4149 657    |           | 0                             | 4155 588    |           | 00                            |
| 4149 700    |           | 00                            | 4155 683    |           | 00                            |
| 4149 857    |           | 000                           | 4155 802    |           | 00                            |
| 4149 923    |           | 2                             | 4155 875    |           | 000                           |
| 4150 056    | Ce        | 00                            | 4156 072    |           | 1                             |
| 4150 139    |           | 00                            | 4156 238    | Nd        | 0                             |
| 4150 258    |           | 00 N                          | 4156 391    | Zr        | 1                             |
| 4150 411    |           | 4                             | 4156 471    |           | 3                             |
| 4150 535    |           | 00                            | 4156 612    |           | 1                             |
| 4150 608    | Co        | 1                             | 4156 764    |           | 00                            |
| 4150 706    |           | 00                            | 4156 831    |           | 1                             |
| 4150 865    |           | 00 N                          | 4156 970    | Fe        | 3 d?                          |
| 4150 964    | Ce        | 00 N                          | 4157 167    | Mn        | 00 N                          |
| 4151 129    | Zr, Ti    | 1                             | 4157 356    | C?        | 0                             |
| 4151 225    |           | 00                            | 4157 398    | C?        | 000                           |
| 4151 360    | C?        | 0000                          | 4157 586    |           | 00 Nd?                        |
| 4151 429    | C?        | 000                           | 4157 738    |           | 00                            |
| 4151 569    | C?        | 0000                          | 4157 948 s  | Fe        | 5                             |
| 4151 638    | C?        | 0000                          | 4158 171    | C         | 00                            |
| 4151 726    |           | 00                            | 4158 242    | C         | 00                            |
| 4151 826    |           | 00                            | 4158 428    | C         | 00                            |
| 4151 925    |           | 0                             | 4158 538    | C?        | 0                             |
| 4152 108    | Fe, La    | 2                             | 4158 586    | C?        | 00                            |
| 4152 242    | Ce?       | 1                             | 4158 700    | Co        | 00                            |
| 4152 343    | Fe        | 3                             | 4158 959    | Fe        | 5                             |
| 4152 474    | C         | 00                            | 4159 207    |           | 00                            |
| 4152 547    | C?        | 00                            | 4159 353    |           | 5                             |
| 4152 687    | C?        | 00                            | 4159 401    |           | 000                           |
| 4152 759    | Zr        | 00                            | 4159 562    |           | 00                            |
| 4152 927    | Cr, La    | 0                             | 4159 640    |           | 00                            |
| 4153 071    |           | 00 N                          | 4159 805    | Ti        | 0                             |
| 4153 222    | Cr        | 00                            | 4160 025    |           | 0 Nd?                         |
| 4153 283    |           | 000                           | 4160 256    |           | 0                             |
| 4153 404    | C?        | 0000                          | 4160 408    |           | 00                            |
| 4153 542    | Fe        | 1                             | 4160 530    |           | 2                             |
| 4153 652    | C?        | 00                            | 4160 722    |           | 0                             |
| 4153 776    | Co        | 0                             | 4160 942    |           | 0                             |
| 4153 971    | Cr        | 1                             | 4161 089    |           | 00 N                          |
| 4154 071    | Fe        | 4                             | 4161 239    |           | 2                             |
| 4154 265    |           | 2                             | 4161 369    | Zi-       | 2                             |
| 4154 364    |           | 000                           | 4161 471    |           | 000                           |
| 4154 448    |           | 0                             | 4161 571    | Cr        | 00                            |
| 4154 539    |           | 00                            | 4161 682    |           | 4                             |
| 4154 667    | Fe        | 4                             | 4161 834    |           | 0000                          |
| 4154 824    | C?        | 00                            | 4161 961    | Sr        | 1                             |
| 4154 976    | Fe        | 4                             | 4162 110    |           | 000 N                         |
| 4155 126    |           | 000                           | 4162 281    |           | 00 N                          |
| 4155 213    |           | 00                            | 4162 454    |           | 00 N                          |
| 4155 359    |           | 00                            | 4162 623    |           | 1 N                           |

| Wave length | Substance | Intensity and Character | Wave length | Substance          | Intensity and Character |
|-------------|-----------|-------------------------|-------------|--------------------|-------------------------|
| 4162 825    |           | 1 N                     | 4169 499    |                    | 00                      |
| 4163 068    |           | 00                      | 4169 628    |                    | 00                      |
| 4163 144    |           | 000                     | 4169 775    |                    | 1 N d?                  |
| 4163 281    |           | 000 N d?                | 4169 926    |                    | 2                       |
| 4163 449    |           | 00                      | 4170 009    | Cr                 | 00                      |
| 4163 516    |           | 000                     | 4170 149    |                    | 00                      |
| 4163 642    |           | 0 d                     | 4170 304    |                    | 00                      |
| 4163 818    | 11, Cr    | 4                       | 4170 372    | Cr                 | 00                      |
| 4163 959    |           | 000                     | 4170 506    |                    | 00                      |
| 4164 069    |           | 00                      | 4170 646    |                    | 00                      |
| 4164 180    |           | 00                      | 4170 797    |                    | 00                      |
| 4164 313    |           | 000                     | 4170 900    |                    | 000                     |
| 4164 423    |           | 0                       | 4171 068    | Fe                 | 4                       |
| 4164 493    |           | 0                       | 4171 213    | 11,                | 4                       |
| 4164 673    |           | 00                      | 4171 433    |                    | 000 N                   |
| 4164 804    |           | 0                       | 4171 597    |                    | 00                      |
| 4164 945    |           | 0                       | 4171 720    |                    | 00                      |
| 4165 121    |           | 000                     | 4171 854 *  | Cr, La, Mn, Ni, Fe | 2                       |
| 4165 277    |           | 0                       | 4172 066    | 11, Fe             | 2                       |
| 4165 328    |           | 00                      | 4172 211    | Al?                | 1                       |
| 4165 550    | Fe        | 3 d?                    | 4172 296    | Fe                 | 2                       |
| 4165 676    | Cl        | 00                      | 4172 447    |                    | 000                     |
| 4165 759    | Ce,-      | 2                       | 4172 509    |                    | 00                      |
| 4165 951    |           | 00                      | 4172 641    |                    | 0                       |
| 4166 161    | Ba        | 0                       | 4172 748    |                    | 00                      |
| 4166 262    |           | 00                      | 4172 803    |                    | 2                       |
| 4166 356    |           | 00                      | 4172 923    | Fe                 | 4                       |
| 4166 458    |           | 0                       | 4173 045    |                    | 000                     |
| 4166 511    |           | 000                     | 4173 136    |                    | 1                       |
| 4166 691    |           | 000                     | 4173 309    |                    | 00 Nd?                  |
| 4166 823    |           | 00 N d?                 | 4173 480    | Fe                 | 2                       |
| 4167 013    |           | 00 N d?                 | 4173 624    |                    | 3                       |
| 4167 126    | Ce        | 0                       | 4173 710    |                    | 3                       |
| 4167 197    |           | 000                     | 4173 841    |                    | 00                      |
| 4167 332    |           | 000                     | 4173 950    |                    | 00                      |
| 4167 438    |           | 8                       | 4174 095    | Fe                 | 3                       |
| 4167 560    |           | 00                      | 4174 240    |                    | 0                       |
| 4167 737    |           | 1 N d?                  | 4174 343    |                    | 000                     |
| 4167 884    | C         | 1 N                     | 4174 479    |                    | 00                      |
| 4168 025    |           | 2                       | 4174 568    |                    | 0                       |
| 4168 133    | 11, Ni    | 2                       | 4174 647    |                    | 000                     |
| 4168 279    |           | 0000                    | 4174 807    |                    | 00 N                    |
| 4168 336    |           | 000                     | 4174 973    | Cr                 | 0                       |
| 4168 446    |           | 0000                    | 4175 082    | Fe                 | 4                       |
| 4168 634    |           | 00 N                    | 4175 292    |                    | 1 N                     |
| 4168 784    |           | 2                       | 4175 383    |                    | 000                     |
| 4168 957    |           | 00                      | 4175 496    | Cr                 | 00                      |
| 4169 110    |           | 2                       | 4175 625    |                    | 00                      |
| 4169 253    |           | 00                      | 4175 806    | Fe                 | 5                       |
| 4169 411    |           | 00                      | 4175 941    |                    | 000                     |

\* Probably due to some common impurity of unknown origin. Is it Al? or Si? The Gallium line is also in this region, but I have no specimen of Gallium with which to determine its exact position. The Fe line is strong enough alone to account for it

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 4176 074    |           | 1                       | 4183 011    |           | 00                      |
| 4176 222    |           | 000                     | 4183 169    |           | 1                       |
| 4176 427    |           | 00 N                    | 4183 348    |           | 00                      |
| 4176 569    |           | 00 N                    | 4183 480    | Zr        | 1 N                     |
| 4176 739    | Fe-Mn     | 5                       | 4183 619    |           | 2 N                     |
| 4177 034    |           | 0                       | 4183 787    |           | 00 N                    |
| 4177 153    |           | 00                      | 4183 964    |           | 00 d?                   |
| 4177 243    |           | 0                       | 4184 158    |           | 4                       |
| 4177 356    |           | 000                     | 4184 472    |           | 2                       |
| 4177 495    | Nd        | 0                       | 4184 641    |           | 0                       |
| 4177 582    |           | 000                     | 4184 794    |           | 000 N                   |
| 4177 698    | Fe        | 3                       | 4185 058 s  | Fe, Cr    | 4                       |
| 4177 772    |           | 3                       | 4185 155    |           | 000                     |
| 4177 864    |           | 1                       | 4185 310    |           | 00 N                    |
| 4178 012    |           | 1 N                     | 4185 523    |           | 00 N                    |
| 4178 160    |           | 00                      | 4185 705    |           | 00 N                    |
| 4178 223    |           | 2                       | 4185 807    |           | 00                      |
| 4178 402    |           | 00 N                    | 4185 939    |           | 0 Nd?                   |
| 4178 547    |           | 0                       | 4186 130    |           | 00 N                    |
| 4178 644    |           | 00                      | 4186 280    | Ti        | 1                       |
| 4178 790    |           | 00                      | 4186 496    | Cr        | 0 N                     |
| 4178 884    |           | 000                     | 4186 622    | C?        | 000                     |
| 4179 025    |           | 3                       | 4186 778    | Ce Zr     | 2 N                     |
| 4179 106    |           | 0000                    | 4186 955    | C?        | 0000                    |
| 4179 218    |           | 00                      | 4187 204    | Fe        | 6                       |
| 4179 359    |           | 00                      | 4187 409    | La, C     | 00                      |
| 4179 408    | Cr, Co    | 0                       | 4187 496    | C         | 00                      |
| 4179 542    | V,-       | 3 d?                    | 4187 615    |           | 000                     |
| 4179 743    |           | 00                      | 4187 747    | Fe        | 2                       |
| 4179 837    |           | 00                      | 4187 878    | Zr        | 0                       |
| 4179 978    | Zr        | 0                       | 4187 943    | Fe        | 5                       |
| 4180 159    |           | 000                     | 4188 019    |           | 3                       |
| 4180 206    | C?        | 00                      | 4188 255    | C         | 00 N                    |
| 4180 314    | C?        | 000                     | 4188 479    |           | 00 Nd?                  |
| 4180 405    | C?        | 00                      | 4188 608    |           | 000                     |
| 4180 563    |           | 1                       | 4188 741    | C         | 0000                    |
| 4180 732    |           | 00                      | 4188 894    |           | 4                       |
| 4180 839    |           | 000                     | 4189 138    | C,-       | 1                       |
| 4180 970    | C         | 2 N                     | 4189 264    |           | 1                       |
| 4181 065    | Ti        | 000 N                   | 4189 490    |           | 000 N                   |
| 4181 243    |           | 00                      | 4189 723    | C,-       | 2                       |
| 4181 353    |           | 0                       | 4189 983    | V         | 0 Nd?                   |
| 4181 515    |           | 00 N                    | 4190 147    | Mn        | 0 N                     |
| 4181 708    |           | 1                       | 4190 287    | Cr        | 0 N                     |
| 4181 919    | Fe        | 5                       | 4190 397    | C         | 0                       |
| 4182 136    |           | 2                       | 4190 552    |           | 00                      |
| 4182 376    |           | 00 d?                   | 4190 687    |           | 00                      |
| 4182 548    | Fe        | 3                       | 4190 874    | C, Co     | 1 Nd?                   |
| 4182 755    |           | 00                      | 4191 055    |           | 00 Nd?                  |
| 4182 922    |           | 2                       | 4191 240    |           | 00 N                    |

| Wave length | Substance | Intensity and Character | Wave length | Substance      | Intensity and Character |
|-------------|-----------|-------------------------|-------------|----------------|-------------------------|
| 4191 321    |           | 000                     | 4198 221    | Fe             | 2                       |
| 4191 433    | C, Cr     | 0                       | 4198 295    |                | 0                       |
| 4191 595    | Fe        | 6                       | 4198 402    |                | 4                       |
| 4191 843    | Fe        | 3                       | 4198 494    | Fe             | 4                       |
| 4192 017    | C         | 00                      | 4198 584    |                | 00                      |
| 4192 171    | Cr        | 0                       | 4198 680    |                | 00                      |
| 4192 258    | La?       | 00                      | 4198 800    | Fe             | 3                       |
| 4192 356    | La?       | 00                      | 4198 890    |                | 000                     |
| 4192 557    | C         | 00 N                    | 4199 019    | Cr             | 000 N                   |
| 4192 728    |           | 2 N                     | 4199 267 s  | Zr-Fe          | 5                       |
| 4192 910    |           | 00 N                    | 4199 434    |                | 00                      |
| 4193 072    | C         | 00 N d?                 | 4199 535    |                | 00                      |
| 4193 274    |           | 00 N d?                 | 4199 682    |                | 0000 N                  |
| 4193 433    |           | 00                      | 4199 831    |                | 00                      |
| 4193 545    | C         | 00                      | 4199 901    |                | 000                     |
| 4193 611    | C         | 00                      | 4200 045    |                | 1 N                     |
| 4193 778    |           | 00                      | 4200 148    | Fe             | 2                       |
| 4193 836    | Cr        | 0                       | 4200 261    | Cr             | 00                      |
| 4193 964    | C         | 0                       | 4200 451    |                | 000                     |
| 4194 035    | C         | 00                      | 4200 611    | Ni             | 1                       |
| 4194 246    |           | 000 N d?                | 4200 761    |                | 1                       |
| 4194 398    | C         | 00                      | 4200 858    |                | 0                       |
| 4194 471    | C         | 00                      | 4200 946    | Γ <sub>1</sub> | 1                       |
| 4194 646    |           | 0                       | 4201 089    | Fe             | 3                       |
| 4194 784    | C         | 00                      | 4201 227    |                | 00                      |
| 4194 886    | C, -      | 1                       | 4201 402    |                | 00                      |
| 4195 006    | Cr        | 1                       | 4201 486    |                | 00                      |
| 4195 155    | C         | 0 d?                    | 4201 585    | Zr             | 0000                    |
| 4195 318    |           | 000                     | 4201 733    |                | 00                      |
| 4195 492    | Fe        | 5                       | 4201 869    | Fe, Ni-Mn      | 1                       |
| 4195 572    | C         | 00                      | 4202 198 s  | Fe             | 8                       |
| 4195 684    |           | 1                       | 4202 514    |                | 0 N d?                  |
| 4195 785    | Fe C      | 2                       | 4202 668    |                | 00                      |
| 4195 987    |           | 00 N                    | 4202 750    |                | 00                      |
| 4196 108    | C         | 0 N                     | 4202 919    |                | 2                       |
| 4196 372    | Fe        | 4                       | 4203 100    |                | 0 N                     |
| 4196 516    | C         | 00                      | 4203 287    |                | 1 N                     |
| 4196 576    | C         | 00                      | 4203 464    |                | 00 N                    |
| 4196 699    | La        | 2                       | 4203 620    | Ti             | 00 N                    |
| 4196 837    | Fe        | 1                       | 4203 730    | Cr             | 2                       |
| 4196 929    | C         | 00                      | 4203 851    |                | 0000                    |
| 4197 041    | C         | 00                      | 4203 935    | Ti             | 00                      |
| 4197 153    | C         | 000                     | 4204 101    | Fe             | 3                       |
| 4197 257 s  | C         | 2                       | 4204 163    | La             | 4                       |
| 4197 390    | Cr        | 0                       | 4204 359    | Cr             | 0                       |
| 4197 518    |           | 00                      | 4204 499    |                | 00                      |
| 4197 666    |           | 000                     | 4204 622    | Cr             | 0                       |
| 4197 806    |           | 00                      | 4204 761    |                | 00                      |
| 4197 901    |           | 00                      | 4204 884    |                | 1                       |
| 4198 053    |           | 0000                    | 4204 916    |                | 2                       |

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 4205 054    |           | 000                     | 4212 200    |           | 00 N                    |
| 4205 186    |           | 1                       | 4212 393    | C         | 00 Nd?                  |
| 4205 239    |           | 1                       | 4212 564    |           | 00                      |
| 4205 421    |           | 000                     | 4212 801    | Cr?       | 3 N                     |
| 4205 545    | Fe        | 1 N                     | 4213 010    | C         | 00                      |
| 4205 702    |           | 2                       | 4213 135    |           | 00 N                    |
| 4205 894    |           | 000 N                   | 4213 323    | C, Cr     | 0 N                     |
| 4206 059    |           | 00                      | 4213 434    | C?        | 000                     |
| 4206 127    |           | 000                     | 4213 579    |           | 00                      |
| 4206 289    |           | 000 N                   | 4213 679    | C         | 000                     |
| 4206 461    |           | 0                       | 4213 812    | Fe        | 3                       |
| 4206 583    |           | 00                      | 4213 991    |           | 0                       |
| 4206 735    |           | 1                       | 4214 070    | Zr-C      | 0                       |
| 4206 862    | Fe        | 3                       | 4214 198    |           | 00                      |
| 4207 059    | Cr        | 00                      | 4214 295    |           | 000                     |
| 4207 109    |           | 0000                    | 4214 406    | C         | 00                      |
| 4207 291    | Fe        | 3                       | 4214 527    |           | 00                      |
| 4207 410    |           | 000                     | 4214 634    |           | 00                      |
| 4207 566    | Fe        | 1 N                     | 4214 787    | C         | 00                      |
| 4207 788    |           | 00 N d?                 | 4214 994    |           | 00                      |
| 4207 982    |           | 0                       | 4215 075    | C         | 00                      |
| 4208 110    |           | 0000                    | 4215 221    |           | 0                       |
| 4208 266    |           | 00                      | 4215 337    | C         | 00                      |
| 4208 333    |           | 000                     | 4215 459    | C         | 00                      |
| 4208 415    |           | 00                      | 4215 581 s  | Fe        | 2                       |
| 4208 514    | Cr        | 0                       | 4215 703 s  | Sr        | 5 d?                    |
| 4208 609    |           | 00                      | 4215 924    |           | 00                      |
| 4208 766    | Fe        | 3                       | 4215 971    |           | 000                     |
| 4208 941    |           | 00                      | 4216 136 s  | C         | 1                       |
| 4209 015    | C         | 00                      | 4216 351    | Fe        | 3 d?                    |
| 4209 144    | Zr        | 1                       | 4216 516    | Cr        | 0                       |
| 4209 347    |           | 00 N d?                 | 4216 760    |           | 1 N                     |
| 4209 521    | Cr        | 0                       | 4216 966    |           | 000                     |
| 4209 660    | C         | 0                       | 4217 061    |           | 000                     |
| 4209 762    |           | 0                       | 4217 220    |           | 00                      |
| 4209 914    | Cr        | 0                       | 4217 365    |           | 1                       |
| 4209 985    | V         | 1                       | 4217 420    |           | 1                       |
| 4210 224    | C         | 00 N d?                 | 4217 720    | La, Fe-C1 | 5 d?                    |
| 4210 494    | Fe        | 4                       | 4217 917    |           | 000                     |
| 4210 561    |           | 3                       | 4218 038    |           | 000                     |
| 4210 662    |           | 0000                    | 4218 214    |           | 00                      |
| 4210 783    | -C        | 00                      | 4218 384    |           | 1                       |
| 4210 860    | C         | 000                     | 4218 558    | -Zr       | 1 N d                   |
| 4211 127    |           | 3 N                     | 4218 726    |           | 000                     |
| 4211 350    |           | 00 N                    | 4218 885    |           | 3 N                     |
| 4211 512    | C-Cr      | 0 N                     | 4219 081    |           | 000 N                   |
| 4211 675    |           | 00                      | 4219 177    |           | 000 N                   |
| 4211 795    |           | 000                     | 4219 358    |           | 1                       |
| 4211 899    | Mn, C     | 0                       | 4219 516    | Fe        | 4                       |
| 4212 048    | Zr        | 2                       | 4219 580    |           | 3                       |



TABLE OF SOLAR SPECTRUM WAVE-LENGTHS 41

| Wave length  | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|--------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 4219 756     |           | 000                     | 4227 129    |           | 1 N d?                  |
| 4219 895     |           | 00                      | 4227 316    |           | 00 N                    |
| 4220 064     |           | 00                      | 4227 474    |           | 1 N                     |
| 4220 212     |           | 1                       | 4227 606    | Fe        | 4                       |
| 4220 330     |           | 00                      | 4227 822    | Li        | 00                      |
| 4220 509     | Fe        | 3                       | 4227 918    | Zr        | 0                       |
| 4220 643     |           | 0000                    | 4228 103    |           | 1 N                     |
| 4220 738     | Mn        | 000                     | 4228 265    |           | 000                     |
| 4220 813     |           | 00                      | 4228 475    |           | 00 N                    |
| 4220 967     |           | 00                      | 4228 716    |           | 000                     |
| 4221 179     |           | 000                     | 4228 879    |           | 1                       |
| 4221 332     |           | 00                      | 4229 032    |           | 000                     |
| 4221 468     |           | 00                      | 4229 206    |           | 00 N                    |
| 4221 633     |           | 1 N                     | 4229 419    |           | 000                     |
| 4221 737     | Cl        | 0                       | 4229 566    |           | 0                       |
| 4221 853     |           | 00                      | 4229 677    | Fe        | 2                       |
| 4221 975     |           | 000                     | 4229 926    | Fe        | 3                       |
| 4222 183     |           | 000                     | 4230 075    |           | 1 N                     |
| 4222 382 s   | Fe        | 5                       | 4230 267    |           | 00 N                    |
| 4222 611     |           | 00 N d?                 | 4230 413    |           | 00 Nd?                  |
| 4222 768     |           | 0                       | 4230 560    | Cr        | 000                     |
| 4222 890     | Cl        | 0                       | 4230 638    |           | 0                       |
| 4223 061     |           | 00 N                    | 4230 734    |           | 0                       |
| 4223 256     |           | 1 N                     | 4230 861    |           | 000                     |
| 4223 396     |           | 0                       | 4230 985    |           | 00                      |
| 4223 509     |           | 00                      | 4231 183    | Ni        | 4 N                     |
| 4223 643     |           | 1                       | 4231 360    |           | 000 N                   |
| 4223 738     |           | 1                       | 4231 573    |           | 000 Nd?                 |
| 4223 891     |           | 0                       | 4231 767    | Al        | 1                       |
| 4224 060     |           | 00                      | 4231 846    |           | 1                       |
| 4224 138     |           | 000                     | 4231 997    |           | 0000                    |
| 4224 337     | Fe        | 4                       | 4232 111    | Nb?       | 1                       |
| 4224 463     |           | 0                       | 4232 201    |           | 000 N                   |
| 4224 619     |           | 0                       | 4232 353    |           | 00 N                    |
| 4224 673     | Cr Fe     | 3                       | 4232 544    |           | 00                      |
| 4224 792     | Li        | 00                      | 4232 618    |           | 00                      |
| 4225 020     |           | 2 N                     | 4232 765    | V         | 00                      |
| 4225 206     |           | 000                     | 4232 887    | Fe        | 2                       |
| 4225 378     |           | 0                       | 4233 013    |           | 000                     |
| 4225 490     |           | 000                     | 4233 086    | -V        | 1 N                     |
| 4225 619     | Fe        | 3                       | 4233 328    | Mn Fe     | 4                       |
| 4225 874     |           | 1                       | 4233 404    |           | 00                      |
| 4225 970     |           | 000                     | 4233 564    |           | 000 N                   |
| 4226 116     | Fe        | 2                       | 4233 772    | Fe        | 6                       |
| 4226 239     |           | 000                     | 4234 171    | Co, V     | 0 N                     |
| 4226 381     |           | 000                     | 4234 385    |           | 0 N                     |
| 4226 510     |           | 0                       | 4234 565    |           | 00                      |
| 4226 584     | Fe        | 2                       | 4234 707    | Zi        | 0 N                     |
| 4226 724     | Si?       | 0                       | 4234 895    |           | 000 N                   |
| 4226 904 s g | Ca        | 20 d?                   | 4235 054    |           | 000 N                   |

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 4235 155    | Mn        | 0000                    | 4242 167    | Fe        | 000                     |
| 4235 298    |           | 2                       | 4242 322    |           | 0                       |
| 4235 450    | Mn        | 3                       | 4242 443    |           | 0                       |
| 4235 679    | Fe        | 000                     | 4242 535    |           | 2                       |
| 4235 796    |           | 00                      | 4242 615    |           | 2                       |
| 4235 894    |           | 0                       | 4242 766    |           | 2                       |
| 4235 994    |           | 0                       | 4242 897    |           | 2                       |
| 4236 112    |           | 8                       | 4243 060    |           | 0000 N                  |
| 4236 279    |           | 1                       | 4243 181    |           | 0000 N                  |
| 4236 429    |           | 1                       | 4243 364    |           | 1 d?                    |
| 4236 540    |           | 00                      | 4243 518    |           | 1                       |
| 4236 714    |           | 00 N                    | 4243 608    | Fe        | 3                       |
| 4236 801    | Ni        | 00                      | 4243 714    |           | 1                       |
| 4236 966    |           | 1 d                     | 4243 981    |           | 2                       |
| 4237 119    |           | 0                       | 4244 153    |           | 00                      |
| 4237 240    |           | 1                       | 4244 245    |           | 00                      |
| 4237 339    |           | 3                       | 4244 406    |           | 0                       |
| 4237 412    |           | 1                       | 4244 500    |           | 00                      |
| 4237 655    |           | 000 N                   | 4244 568    |           | 00                      |
| 4237 836    |           | 0                       | 4244 717    |           | 0000                    |
| 4237 946    |           | 000                     | 4244 888    |           | 00                      |
| 4238 050    | Fe        | 00                      | 4244 971    |           | 00                      |
| 4238 188    |           | 3                       | 4245 104    | Fe        | 0000                    |
| 4238 398    |           | 00                      | 4245 243    |           | 0 N                     |
| 4238 555    |           | 1 N t?                  | 4245 422    |           | 4                       |
| 4238 778    |           | 00 N                    | 4245 520    |           | 2                       |
| 4238 918    |           | 0                       | 4245 671    |           | 0000                    |
| 4238 970    |           | 5                       | 4245 772    |           | 0000 N                  |
| 4239 107    |           | 00                      | 4245 969    |           | 0000 N                  |
| 4239 203    |           | 0000                    | 4246 071    |           | 00                      |
| 4239 304    |           | 000                     | 4246 180    | Fe        | 0                       |
| 4239 525    |           | 2                       | 4246 251    |           | 2                       |
| 4239 642    | Zr        | 00                      | 4246 415    |           | 00 N                    |
| 4239 759    |           | 00                      | 4246 577    |           | 0 N                     |
| 4239 890    |           | 3                       | 4246 729    |           | 000                     |
| 4240 014    |           | 3                       | 4246 996    |           | 5                       |
| 4240 115    |           | 1                       | 4247 279    | Y?        | 00 N                    |
| 4240 246    |           | 000                     | 4247 464    |           | 1                       |
| 4240 359    |           | 0 N                     | 4247 591    |           | 4                       |
| 4240 540    |           | 2                       | 4247 726    |           | 0                       |
| 4240 622    |           | 1                       | 4247 886    |           | 0                       |
| 4240 763    |           | 000                     | 4248 057    |           | 000                     |
| 4240 872    |           | 1                       | 4248 215    |           | 0 N d?                  |
| 4240 959    |           | 000                     | 4248 384    |           | 2                       |
| 4241 127    |           | 00 N d?                 | 4248 485    |           | 00                      |
| 4241 285    | Fe-Zr     | 2                       | 4248 575    | Fe<br>Ti  | 1                       |
| 4241 485    |           | 00 N                    | 4248 696    |           | 0                       |
| 4241 682    |           | 00 N                    | 4248 882    |           | 2 N                     |
| 4241 866    |           | 00 N                    | 4249 102    |           | 2 N                     |
| 4242 002    |           | 000                     | 4249 272    |           | 00                      |

| Wave length  | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|--------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 4249 416     |           | 000                     | 4258 201    | Zr        | 0                       |
| 4249 507     |           | 00                      | 4258 219    |           | 1 N                     |
| 4249 648     |           | 1 N                     | 4258 477    | Fe        | 2                       |
| 4249 797     |           | 2 N                     | 4258 639    |           | 0 N                     |
| 4249 959     |           | 000 N                   | 4258 774    | Fe        | 2                       |
| 4250 205     |           | 000                     | 4258 885    |           | 1 N                     |
| 4250 287 s   | Fe        | 8                       | 4259 113    | Fe        | 2                       |
| 4250 629     |           | 00                      | 4259 249    |           | 0                       |
| 4250 863     |           | 0                       | 4259 305    |           | 0                       |
| 4250 945 } s | Fe        | 8                       | 4259 460    |           | 1 N d?                  |
| 4251 071 } s |           | 1                       | 4259 664    |           | 000 N                   |
| 4251 491     |           | 0 d?                    | 4259 917    |           | 0 N                     |
| 4251 662     |           | 000                     | 4260 151    | Fe        | 2                       |
| 4251 783     | Ti        | 00                      | 4260 282    | Fe        | 3 d?                    |
| 4251 905     | Li        | 00                      | 4260 494    |           | 0 N                     |
| 4252 043     |           | 000                     | 4260 640    | Fe        | 10                      |
| 4252 218     |           | 00 N d?                 | 4260 768    |           | 0 N                     |
| 4252 388     |           | 00                      | 4260 888    |           | 1                       |
| 4252 468     | Co        | 0                       | 4260 991    | Ti        | 0                       |
| 4252 618     |           | 00 N                    | 4261 162    |           | 000 N                   |
| 4252 785     |           | 0 N                     | 4261 376    |           | 2                       |
| 4252 917     |           | 1 N                     | 4261 496    | Cl, Mn    | 0                       |
| 4253 157     |           | 1                       | 4261 679    | Cl        | 2                       |
| 4253 363     |           | 1                       | 4261 748    | Li        | 00                      |
| 4253 522     |           | 00                      | 4261 891    |           | 2                       |
| 4253 696     |           | 00                      | 4262 086    |           | 1                       |
| 4253 888     |           | 0                       | 4262 142    |           | 1                       |
| 4254 063     |           | 1                       | 4262 287    | Cr        | 00                      |
| 4254 236     |           | 000                     | 4262 498    | Cl        | 0                       |
| 4254 505 s   | Cr        | 8                       | 4262 733    |           | 00                      |
| 4254 821     |           | 000 N                   | 4262 864    |           | 0                       |
| 4255 002     |           | 00                      | 4263 126    |           | 000                     |
| 4255 134     | Fe        | 2 d?                    | 4263 290    | Li, Cl    | 2                       |
| 4255 406     |           | 1                       | 4263 419    |           | 0                       |
| 4255 659     | Fe, Cr    | 1                       | 4263 581    |           | 00 N                    |
| 4255 791     |           | 1 N                     | 4263 760    | La        | 0 d?                    |
| 4255 993     | Fe        | 2 N                     | 4263 996    |           | 000 N                   |
| 4256 177     |           | 00                      | 4264 128    |           | 1                       |
| 4256 287     | Ti        | 0                       | 4264 370    | Fe        | 3                       |
| 4256 366     |           | 1                       | 4264 431    |           | 00                      |
| 4256 469     |           | 00                      | 4264 615    |           | 1                       |
| 4256 575     | Zr        | 00                      | 4264 738    |           | 00                      |
| 4256 760     |           | 0                       | 4264 895    | Fe        | 2                       |
| 4256 966     |           | 0                       | 4265 083    |           | 00                      |
| 4257 294     |           | 00 N                    | 4265 238    |           | 000                     |
| 4257 517     |           | 00                      | 4265 418    | Fe        | 2                       |
| 4257 661     |           | 000                     | 4265 584    |           | 00                      |
| 4257 815     | Mn        | 2                       | 4265 696    |           | 0                       |
| 4257 977     |           | 000                     | 4265 832    | Ti        | 0                       |
| 4258 079     |           | 0000                    | 4266 081    | Mn        | 2                       |

# PRELIMINARY TABLE OF SOLAR SPECTRUM WAVE-LENGTHS IV

By HENRY A ROWLAND

| Wave length    | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|----------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 4266 233       | Ti        | ooo                     | 4272 114    | Ti-       | 1 N                     |
| 4266 374       |           | oo                      | 4272 299    |           | ooo N                   |
| 4266 586       |           | oo N                    | 4272 458    |           | o N                     |
| 4266 778       | Cl        | o                       | 4272 590    | Fe        | oo                      |
| 4266 894       |           | o                       | 4272 701    |           | 1                       |
| 4267 122       |           | 3                       | 4272 869    |           | ooo                     |
| 4267 291       | Fe        | ooo N                   | 4273 049    | Zr        | 1 d?                    |
| 4267 439       |           | ooo                     | 4273 274    |           | oo N                    |
| 4267 543       |           | 2 N                     | 4273 482    | Fe?       | 3 N                     |
| 4267 741       | Zr        | oo                      | 4273 643    |           | 2 N                     |
| 4267 900       |           | 1                       | 4273 835    |           | oo                      |
| (4267 950) } s | Fe        |                         | 4273 946    | Ti        | o                       |
| 4267 985       |           | 3                       | 4274 045    |           | 1                       |
| 4268 138       |           | o                       | 4274 096    |           | 1                       |
| 4268 266       | Zr        | 1 N                     | 4274 348    | Cr        | 2 N                     |
| 4268 449       |           | ooo N                   | 4274 542    |           | oo N                    |
| 4268 606       |           | ooo N                   | 4274 746    | Ti        | 2                       |
| 4268 783       | Fe        | o                       | 4274 958 s  |           | 7 d?                    |
| 4268 915       |           | 2                       | 4275 115    |           | o                       |
| 4269 088       | La        | oo N                    | 4275 262    | Ti        | oo                      |
| 4269 202       |           | oo N                    | 4275 413    |           | o N                     |
| 4269 339       |           | ooo                     | 4275 541    | Zr        | o N                     |
| 4269 446       | Ti-       | o                       | 4275 667    |           | oooo                    |
| 4269 625       |           | o                       | 4275 713    |           | o                       |
| 4269 746       |           | oo                      | 4275 814    | V-        | o                       |
| 4269 898       | Fe        | 2                       | 4275 866    |           | o                       |
| 4270 016       |           | 2 N                     | 4276 050    |           | ooo N                   |
| 4270 120       | Ti-       | oo                      | 4276 150    | Ti        | oo N                    |
| 4270 329       |           | 1 N                     | 4276 259    |           | o                       |
| 4270 485       |           | oo                      | 4276 428    | Zr        | o                       |
| 4270 649       | Fe        | oo N                    | 4276 587    |           | o                       |
| 4270 880       |           | oo N                    | 4276 685    | V-        | ooo                     |
| 4271 112       |           | oooo N                  | 4276 836    |           | 2                       |
| 4271 212       | Fe        | o N                     | 4276 979    |           | ooo                     |
| 4271 325       |           | 6                       | 4277 147    | Zr        | 1 N                     |
| 4271 538       |           | o                       | 4277 384    |           | 1 N                     |
| 4271 618       | Fe        | oo                      | 4277 544    |           | o                       |
| 4271 715       |           | oo                      | 4277 692    | Fe        | 2 d?                    |
| 4271 790       |           | o N d?                  | 4277 835    |           | oo                      |
| 4271 934 s     | Fe        | 15                      | 4277 968    |           | oooo                    |



| Wave length | Substance | Intensity and Character | Wave length | Substance      | Intensity and Character |
|-------------|-----------|-------------------------|-------------|----------------|-------------------------|
| 4292 450    |           | 2                       | 4299 846    |                | 00                      |
| 4292 616    |           | 0000                    | 4299 989    |                | 1 N                     |
| 4292 739    |           | 000                     | 4300 135    |                | 0                       |
| 4292 827    |           | 0000                    | 4300 211    | Ti             | 3                       |
| 4292 940    |           | 0000                    | 4300 376    | Mn             | 0                       |
| 4293 035    |           | 0000                    | 4300 478    |                | 1 N                     |
| 4293 192    | s         | 2                       | 4300 732    | Ti             | 2                       |
| 4293 273    |           | 3                       | 4300 895    |                | 0                       |
| 4293 486    |           | 000 N                   | 4300 987    |                | 1                       |
| 4293 714    |           | 00                      | 4301 158    | Ti             | 2                       |
| 4293 817    | Cr        | 000                     | 4301 262    |                | 4                       |
| 4293 957    |           | 0                       | 4301 332    |                | 1                       |
| 4294 077    |           | 000                     | 4301 442    |                | 0                       |
| 4294 204    | Ti        | 2                       | 4301 658    |                | 0 N                     |
| 4294 301    | Fe        | 5                       | 4301 902    |                | 0 N d?                  |
| 4294 531    |           | 00                      | 4302 085    | Ti             | 2                       |
| 4294 781    | W         | 00 N d?                 | 4302 238    |                | 00                      |
| 4294 936    | Zr        | 2                       | 4302 353    | Fe             | 2                       |
| 4295 015    |           | 0000                    | 4302 460    |                | 2                       |
| 4295 194    |           | 3 d?                    | 4302 692 s  | Ca             | 4                       |
| 4295 383    |           | 3 N d?                  | 4302 913    |                | 2 N                     |
| 4295 578    |           | 000                     | 4303 072    |                | 1 N                     |
| 4295 747    |           | 000                     | 4303 247    |                | 0                       |
| 4295 914    | Cr, Ti    | 2                       | 4303 337    |                | 2                       |
| 4296 044    | Ni        | 1                       | 4303 584    |                | 1 N                     |
| 4296 235    | La        | 0 N                     | 4303 754    |                | 1                       |
| 4296 375    |           | 0 N                     | 4303 880    |                | 0                       |
| 4296 548    |           | 000 N                   | 4303 992    |                | 2                       |
| 4296 735    |           | 3                       | 4304 098    |                | 4                       |
| 4296 840    | Zr?       | 1                       | 4304 300    |                | 00                      |
| 4296 933    |           | 0 N                     | 4304 415    |                | 1                       |
| 4297 110    |           | 2                       | 4304 552    |                | 1                       |
| 4297 202    | Cr        | 1                       | 4304 729    |                | 2                       |
| 4297 369    |           | 2                       | 4304 882    | Zr             | 0                       |
| 4297 448    |           | 2                       | 4305 013    |                | 0 N                     |
| 4297 684    |           | 1 N                     | 4305 266    |                | 1                       |
| 4297 908    | Cr, V     | 0                       | 4305 377    |                | 0                       |
| 4298 136    | Ti        | 1                       | 4305 479    |                | 1                       |
| 4298 195    | Fe        | 2                       | 4305 614    | Fe, Sr, Ti, Cr | 3                       |
| 4298 355    |           | 1                       | 4305 772    |                | 000                     |
| 4298 531    |           | 000                     | 4305 871    |                | 2                       |
| 4298 675    | Ni        | 00                      | 4306 006    |                | 1                       |
| 4298 828    | Ti        | 2                       | 4306 078 s  | Ti             | 4                       |
| 4298 967    |           | 2                       | 4306 305    |                | 2 N                     |
| 4299 149 s  | Ca        | 3                       | 4306 521    |                | 00 N                    |
| 4299 296    |           | 1                       | 4306 758    |                | 0                       |
| 4299 410    | Ti, Fe    | 4                       | 4306 858    |                | 2                       |
| 4299 524    |           | 0                       | 4307 017    |                | 2                       |
| 4299 641    |           | 0                       | 4307 215    |                | 000 Nd?                 |
| 4299 803    | Ti        | 2                       | 4307 342    |                | 000                     |

| Wave length               | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|---------------------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 4307 465                  | Ca<br>Fe  | 2 N                     | 4314 673    | Li<br>Fe  | o N                     |
| 4307 720                  |           | 2 N d?                  | 4314 894    |           | oo                      |
| 4307 907 } <sub>3</sub> G |           | 3                       | 4314 964    |           | i                       |
| 4308 c81 }                |           | 6                       | 4315 138    |           | 3                       |
| 4308 206                  |           | o                       | 4315 262    |           | 4                       |
| 4308 334                  |           | i                       | 4315 446    |           | ooo N                   |
| 4308 449                  |           | oo                      | 4315 626    |           | oo N                    |
| 4308 541                  |           | oo                      | 4315 769    |           | oo N                    |
| 4308 601                  |           | oo                      | 4315 901    |           | oooo                    |
| 4308 759                  |           | 2 Nd?                   | 4316 032    |           | ooo                     |
| 4308 937                  | Fe        | ooo                     | 4316 115    | Ti?       | oo                      |
| 4309 063                  |           | i                       | 4316 246    |           | oo N                    |
| 4309 198                  |           | 2                       | 4316 720    |           | ooo N                   |
| 4309 290                  |           | o                       | 4316 832    |           | ooo                     |
| 4309 365                  |           | o                       | 4316 962    |           | i                       |
| 4309 541                  |           | 3                       | 4317 125    |           | o                       |
| 4309 621                  |           | i                       | 4317 226    |           | o                       |
| 4309 792                  |           | i                       | 4317 484    | Zr        | o N                     |
| 4309 876                  |           | i                       | 4317 618    |           | ooo                     |
| 4309 993                  |           | o                       | 4317 883    |           | o N                     |
| 4310 066                  | Fe        | o                       | 4318 064    |           | oo N                    |
| 4310 266                  |           | 2                       | 4318 232    |           | o N                     |
| 4310 388                  |           | i                       | 4318 369    |           | oo                      |
| 4310 540                  |           | 2                       | 4318 522    |           | o N d?                  |
| 4310 631                  |           | i                       | 4318 631    |           | ooo                     |
| 4310 722                  |           | o                       | 4318 817 s  | Ca, Mn?   | 4                       |
| 4310 862                  |           | 2 N                     | 4318 960    |           | oo                      |
| 4311 058                  |           | i                       | 4319 099    |           | oo                      |
| 4311 146                  |           | i                       | 4319 252    |           | ooo N                   |
| 4311 328                  |           | 2                       | 4319 455    |           | ooo N                   |
| 4311 486                  |           | oo                      | 4319 615    |           | o                       |
| 4311 608                  |           | 2                       | 4319 799    | Cr        | o                       |
| 4311 674                  |           | 2                       | 4319 969    |           | ooo N                   |
| 4311 880                  |           | 2 N                     | 4320 140    |           | oo N                    |
| 4312 050                  |           | oo                      | 4320 318    |           | oo                      |
| 4312 247                  |           | 2                       | 4320 535    |           | o                       |
| 4312 311                  | Mn        | i                       | 4320 661    |           | o                       |
| 4312 462                  |           | 2                       | 4320 756    |           | oo                      |
| 4312 665                  |           | oo                      | 4320 907    | Sc        | 3                       |
| 4312 723                  |           | i N                     | 4321 119    |           | 2                       |
| 4312 871                  |           | o                       | 4321 294    |           | oo                      |
| 4313 034                  | Ti        | 3                       | 4321 395    |           | oo                      |
| 4313 193                  |           | i N                     | 4321 583    |           | o N                     |
| 4313 399                  |           | oo N                    | 4321 678    |           | oooo                    |
| 4313 577                  |           | oo N d?                 | 4321 813    | Ti<br>Fe  | o                       |
| 4313 797                  |           | 2 Nd?                   | 4321 961    |           | 2                       |
| 4314 052                  |           | oo N                    | 4322 204    |           | o N                     |
| 4314 248                  | Sc        | 3                       | 4322 373    |           | oo N                    |
| 4314 381                  |           | i                       | 4322 521    |           | oo N                    |
| 4314 479                  |           | i                       | 4322 670    |           | o N                     |

| Wave-length | Substance | Intensity and Character | Wave-length           | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-----------------------|-----------|-------------------------|
| 4322 862    |           | oo N                    | 4330 063              |           | oo                      |
| 4322 992    |           | oo N                    | 4330 189              | V         | o N                     |
| 4323 167    |           | I                       | 4330 405              |           | I                       |
| 4323 222    |           | o                       | 4330 566              |           | o                       |
| 4323 386    |           | 2 N d?                  | 4330 609              |           | o                       |
| 4323 531    |           | o                       | 4330 743              |           | ooo                     |
| 4323 670    |           | I                       | 4330 866 <sup>*</sup> | Ti, Ni    | 2                       |
| 4323 772    |           | o                       | 4330 984              |           | oo                      |
| 4323 872    |           | oooo                    | 4331 119              |           | I                       |
| 4324 007    |           | 3                       | 4331 229              |           | oo                      |
| 4324 138    |           | I                       | 4331 402              |           | ooo Nd?                 |
| 4324 246    | Zi        | o                       | 4331 614              |           | o N                     |
| 4324 340    |           | o                       | 4331 811              | Ni        | 2                       |
| 4324 572    |           | 2 N                     | 4331 944              |           | oo N                    |
| 4324 775    |           | oo                      | 4332 172              |           | oo N                    |
| 4324 886    |           | oo                      | 4332 339              |           | oo N                    |
| 4324 977    |           | o                       | 4332 620              |           | oo                      |
| 4325 152    | Sc        | 4                       | 4332 745              |           | o N                     |
| 4325 306    | Ti, Cr    | I                       | 4332 988              | V         | o                       |
| 4325 516    | Ni, Zr    | I                       | 4333 082              |           | o                       |
| 4325 648    |           | ooo                     | 4333 212              |           | oo                      |
| 4325 777    |           | I                       | 4333 367              |           | o N                     |
| 4325 939 s  | Fe        | 8                       | 4333 525              |           | oo                      |
| 4326 119    |           | I                       | 4333 588              |           | oo                      |
| 4326 213    |           | o                       | 4333 758              |           | ooo                     |
| 4326 383    |           | oooo                    | 4333 925              | La        | I N                     |
| 4326 520    | Ti        | o                       | 4334 063              |           | oo                      |
| 4326 641    |           | ooo N                   | 4334 174              |           | oo                      |
| 4326 779    |           | ooo N                   | 4334 228              |           | oo                      |
| 4326 923    | Fe        | 2                       | 4334 354              |           | oo                      |
| 4327 082    |           | o N d?                  | 4334 407              |           | oo                      |
| 4327 274    | Fe        | 3                       | 4334 600              |           | ooo Nd?                 |
| 4327 319    |           | oo                      | 4334 833              |           | o                       |
| 4327 479    |           | ooo N                   | 4334 965              |           | o                       |
| 4327 616    |           | ooo N d?                | 4335 102              | La        | o                       |
| 4327 961    |           | oo                      | 4335 248              |           | oo N                    |
| 4328 080    | Fe        | 2                       | 4335 434              |           | I N d?                  |
| 4328 202    |           | oo N                    | 4335 611              |           | oo N                    |
| 4328 365    |           | ooo                     | 4335 762              |           | oo Nd?                  |
| 4328 446    |           | ooo                     | 4335 944              |           | oo N                    |
| 4328 598    |           | ooo                     | 4336 076              |           | oo                      |
| 4328 772    |           | o N                     | 4336 147              |           | ooo                     |
| 4329 007    |           | oo                      | 4336 295              |           | oooo                    |
| 4329 089    |           | ooo                     | 4336 433              |           | oo                      |
| 4329 213    |           | oo                      | 4336 602              |           | ooo Nd?                 |
| 4329 306    |           | oooo                    | 4336 774              |           | ooN                     |
| 4329 448    |           | o N                     | 4336 951              |           | oo                      |
| 4329 559    |           | o N                     | 4337 034              |           | oo                      |
| 4329 712    |           | oo                      | 4337 216              | Fe        | 5                       |
| 4329 853    |           | oo                      | 4337 414              | Cr        | o                       |

<sup>\*</sup> This is a weak, hazy Ni line. It is faintly present in a specimen of meteoric iron. The Ni line is on the red edge of the solar line and the Ti line is nearer the center.



| Wave length        | Substance       | Intensity and Character | Wave length | Substance             | Intensity and Character |
|--------------------|-----------------|-------------------------|-------------|-----------------------|-------------------------|
| 4337 569           | Mn'             | 00                      | 4345 506    |                       | 0000                    |
| 4337 725           | Cr              | 3                       | 4345 593    |                       | 0000                    |
| 4337 945           | <del>Sr</del>   | 00                      | 4345 767    |                       | 00 N                    |
| 4338 084           | Ti <sup>+</sup> | 4                       | 4345 933    |                       | 00                      |
| 4338 245           |                 | 000                     | 4346 068    |                       | 0 N                     |
| 4338 292           |                 | 00                      | 4346 278    |                       | 00                      |
| 4338 430           | Fe              | 1                       | 4346 454    |                       | 1                       |
| 4338 616           |                 | 0 d?                    | 4346 580    |                       | 00                      |
| 4338 779           |                 | 00                      | 4346 725    | Fe                    | 2                       |
| 4338 854           |                 | 0                       | 4346 835    |                       | 00                      |
| 4338 993           |                 | 0 N                     | 4346 987    | Cr                    | 1                       |
| 4339 170           |                 | 000                     | 4347 066    |                       | 0000                    |
| 4339 294           |                 | 0                       | 4347 199    |                       | 000                     |
| 4339 416           | Fe              | 0                       | 4347 266    |                       | 000                     |
| 4339 617           | Cr              | 4                       | 4347 403    | Fe                    | 1                       |
| 4339 882           | Cr              | 3                       | 4347 532    |                       | 00 N                    |
| 4340 070           |                 | 000                     | 4347 705    |                       | 1 N                     |
| 4340 192           |                 | 000                     | 4347 845    |                       | 000                     |
| 4340 297           | Cr              | 0                       | 4348 003    | Fe                    | 2                       |
| 4340 634 <i>Hγ</i> | II              | 20 N                    | 4348 130    | CH                    | 1 N                     |
| 4341 007           |                 | 00 N d?                 | 4348 266    |                       | 000                     |
| 4341 167           | V               | 0                       | 4348 349    |                       | 00                      |
| 4341 286           | Zr              | 0000                    | 4348 497    | CH                    | 1 N                     |
| 4341 410           |                 | 00                      | 4348 651    |                       | 00 N                    |
| 4341 530           | Ti? $T_6^+$     | 2                       | 4348 800    |                       | 00 N                    |
| 4341 723           |                 | 00                      | 4348 933    |                       | 00 N                    |
| 4341 880           |                 | 0                       | 4349 107    | Fe                    | 2                       |
| 4341 991           |                 | 0                       | 4349 330    |                       | 000 N                   |
| 4342 087           |                 | 0                       | 4349 538    |                       | 000                     |
| 4342 219           |                 | 000                     | 4349 967    | Q <sup>+</sup>        | 00                      |
| 4342 350           |                 | 0                       | 4350 119    |                       | 00 N d?                 |
| 4342 482           |                 | 00                      | 4350 319    |                       | 0                       |
| 4342 750           |                 | 000 N                   | 4350 413    |                       | 0                       |
| 4343 004           |                 | 000 N                   | 4350 550    | Ba?                   | 00 N                    |
| 4343 150           |                 | 00 N                    | 4350 747    | Fe                    | 0 N                     |
| 4343 372 } s       | Cr              | 2                       | 4350 921    |                       | 0000                    |
| 4343 431 }         | Fe              | 2                       | 4351 000    | I <sup>+</sup>        | 1                       |
| 4343 577           |                 | 00 N                    | 4351 216    | Cr                    | 3                       |
| 4343 662           |                 | 0 N                     | 4351 338    |                       | 00                      |
| 4343 861           | Fe              | 2                       | 4351 464    |                       | 00                      |
| 4344 015           |                 | 0000                    | 4351 551    |                       | 00                      |
| 4344 130           |                 | 1 N                     | 4351 711    | Fe                    | 2                       |
| 4344 306           |                 | 00 N                    | 4351 871    |                       | 0000                    |
| 4344 451           | Ti <sup>+</sup> | 2                       | 4351 930    | Cr Fe <sup>+</sup> CH | 5                       |
| 4344 670           | Cr              | 4                       | 4352 083    | Mg                    | 5 N d?                  |
| 4344 830           |                 | 000                     | 4352 235    |                       | 0 N                     |
| 4344 906           |                 | 00                      | 4352 425    |                       | 0 N                     |
| 4345 052           |                 | 0                       | 4352 559    |                       | 00 N                    |
| 4345 246           |                 | 00                      | 4352 718    |                       | 0 N                     |
| 4345 399           |                 | 0000                    | 4352 908 s  | Fe                    | 4                       |

50 *TABLE OF SOLAR SPECTRUM WAVE-LENGTHS*

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 4353 044    | V         | o                       | 4360 451    | Fe, Zr    | I                       |
| 4353 214    |           | ooo N                   | 4360 644    |           | I                       |
| 4353 337    |           | oo N                    | 4360 796    |           | ooo                     |
| 4353 596    |           | oo N                    | 4360 958    |           | I                       |
| 4353 678    |           | oo N                    | 4361 091    |           | ooo                     |
| 4353 813    |           | oo N                    | 4361 219    |           | ooo Nd?                 |
| 4353 985    |           | oo                      | 4361 405    |           | oo                      |
| 4354 110    |           | o                       | 4361 474    |           | oo                      |
| 4354 228    |           | oo                      | 4361 676    |           | oooo                    |
| 4354 426    |           | o N d?                  | 4361 828    |           | ooo                     |
| 4354 597    |           | oo                      | 4361 955    |           | oo N                    |
| 4354 674    |           | oo                      | 4362 021    |           | oooo                    |
| 4354 776    |           | I                       | 4362 198    |           | ooo                     |
| 4354 927    |           | o N                     | 4362 262    |           | o                       |
| 4355 112    | Ca?       | oo N                    | 4362 387    | Si?       | oo                      |
| 4355 257    |           | 2                       | 4362 542    |           | ooo                     |
| 4355 509    |           | o                       | 4362 690    |           | I                       |
| 4355 578    |           | oo                      | 4362 909    |           | o N                     |
| 4355 746    |           | oo                      | 4363 113    |           | oo N                    |
| 4355 867    |           | o                       | 4363 267    |           | I N                     |
| 4356 058    |           | o                       | 4363 457    |           | o N                     |
| 4356 163    |           | o                       | 4363 629    |           | o                       |
| 4356 299    |           | oo                      | 4363 766    |           | o                       |
| 4356 414    |           | ooo                     | 4363 979    |           | oo N                    |
| 4356 528    |           | o                       | 4364 136    |           | ooo                     |
| 4356 766    |           | o                       | 4364 198    |           | I                       |
| 4356 901    |           | oo                      | 4364 349    |           | I                       |
| 4357 071    | Ni        | o                       | 4364 490    |           | oo                      |
| 4357 223    |           | ooo                     | 4364 662    | Ce        | oo N                    |
| 4357 312    |           | oo N                    | 4364 827    |           | oo                      |
| 4357 457    |           | oo                      | 4365 031    |           | ooo                     |
| 4357 677    |           | o N d?                  | 4365 168    |           | ooo                     |
| 4357 865    |           | ooo                     | 4365 451    |           | oo N                    |
| 4358 033    |           | o                       | 4365 694    |           | o                       |
| 4358 178    |           | oo                      | 4365 885    |           | oo N d?                 |
| 4358 328    |           | o                       | 4366 061    |           | 2                       |
| 4358 521    |           | oo                      | 4366 246    | Fe        | oo N                    |
| 4358 670    |           | 2                       | 4366 362    |           | oo N                    |
| 4358 879    |           | o                       | 4366 572    |           | oo                      |
| 4358 985    |           | oo                      | 4366 660    |           | I                       |
| 4359 084    |           | oo                      | 4366 838    |           | I                       |
| 4359 236    |           | ooo                     | 4367 068    |           | oo                      |
| 4359 358    |           | oo                      | 4367 222    |           | ooo                     |
| 4359 500    |           | oo                      | 4367 354    |           | oo                      |
| 4359 654    |           | o                       | 4367 495    |           | oo                      |
| 4359 784 s  |           | 3                       | 4367 637    |           | oo                      |
| 4359 907    |           | o                       | 4367 749    | Fe        | 5                       |
| 4360 067    | Cr        | oo                      | 4367 839    |           | 2                       |
| 4360 150    |           | oo                      | 4367 882    |           | oo                      |
| 4360 280    |           | oooo                    | 4368 071    |           | 2                       |

| Wave length | Substance          | Intensity and Character | Wave length | Substance          | Intensity and Character |
|-------------|--------------------|-------------------------|-------------|--------------------|-------------------------|
| 4368 224    |                    | oo                      | 4375 216    |                    | ooo                     |
| 4368 291    |                    | o                       | 4375 358    |                    | o N d?                  |
| 4368 462    | Ni                 | o                       | 4375 493    | Cr                 | o                       |
| 4368 629    |                    | ooo                     | 4375 643    |                    | oo                      |
| 4368 801    |                    | o                       | 4375 734    |                    | o                       |
| 4369 052    | Ti                 | oo N d?                 | 4375 823    |                    | o                       |
| 4369 254    |                    | oo                      | 4375 940    |                    | oooo                    |
| 4369 428    |                    | oo                      | 4376 107    | Fe                 | 6                       |
| 4369 568    | Fe <sup>+</sup>    | i                       | 4376 381    |                    | oo N                    |
| 4369 708    |                    | oo N d?                 | 4376 572    |                    | o N                     |
| 4369 873    | Ti                 | o                       | 4376 727    |                    | o N                     |
| 4369 941 s  | Fe CH              | 4                       | 4376 942    | Fe, C <sub>1</sub> | i                       |
| 4370 025    |                    | oo                      | 4377 113    |                    | oo N                    |
| 4370 189    | Ni                 | oo                      | 4377 254    |                    | oo N                    |
| 4370 318    |                    | o                       | 4377 388    |                    | 2 N                     |
| 4370 453    |                    | o                       | 4377 533    |                    | o d?                    |
| 4370 583    |                    | oo                      | 4377 706    |                    | o                       |
| 4370 743    |                    | ooo                     | 4377 948    | Fe                 | i                       |
| 4370 815    |                    | oo                      | 4378 149    |                    | oo N                    |
| 4371 016    |                    | ooo                     | 4378 419    |                    | 2 N d?                  |
| 4371 144    | CH Zr <sup>+</sup> | i                       | 4378 677    |                    | o N d?                  |
| 4371 221    |                    | i                       | 4378 902    |                    | oo N                    |
| 4371 320    |                    | oo                      | 4379 071    |                    | i N                     |
| 4371 442    | Cr                 | 2                       | 4379 232    |                    | oo N                    |
| 4371 588    |                    | o N d?                  | 4379 396*   | V                  | 4                       |
| 4371 748    |                    | ooo                     | 4379 565    |                    | ooo                     |
| 4371 957    |                    | o N                     | 4379 691    |                    | oo                      |
| 4372 115    |                    | oo                      | 4379 798    |                    | ooo                     |
| 4372 184    |                    | oo                      | 4379 927    | Zn + Cr            | o                       |
| 4372 360    |                    | ooo                     | 4380 066    |                    | ooo                     |
| 4372 498    |                    | o d?                    | 4380 325    | Co -               | 2 N d?                  |
| 4372 656    |                    | oo                      | 4380 395    |                    | ooo                     |
| 4372 747    |                    | oooo                    | 4380 521    |                    | oo                      |
| 4372 899    |                    | o                       | 4380 655    |                    | o                       |
| 4373 008    |                    | o                       | 4380 883    |                    | 2 N d?                  |
| 4373 148    | Fe <sup>+</sup>    | o                       | 4381 004    |                    | oo N d?                 |
| 4373 278    |                    | ooo                     | 4381 146    |                    | oo                      |
| 4373 415    | Cr                 | i                       | 4381.274    | Cr                 | o                       |
| 4373 554    |                    | oo N                    | 4381 451    |                    | oo N                    |
| 4373 727    | Fe                 | 2                       | 4381 875    |                    | oo                      |
| 4373 813    |                    | oooo                    | 4382 045    | Mn                 | oo                      |
| 4373 949    | V                  | o                       | 4382 159    |                    | oo                      |
| 4374 055    |                    | o                       | 4382 325    |                    | oo                      |
| 4374 206    |                    | ooo                     | 4382 475    |                    | oo N                    |
| 4374 331    | Cr                 | i                       | 4382 676    |                    | o                       |
| 4374 384    |                    | i                       | 4382 847    | Mn                 | o                       |
| 4374 628    | Sc, FeZi           | 3                       | 4382 928    | Fe                 | 2                       |
| 4374 775    |                    | oo N                    | 4383 156    |                    | o N                     |
| 4374 981    | Zr                 | o                       | 4383 332    |                    | oo N                    |
| 4375 103    | V, Mn              | 2                       | 4383 468    |                    | ooo N                   |

\* The strongest Vanadium lines in the whole solar spectrum or in this part, if not the whole, of the Vanadium spectrum

52      *TABLE OF SOLAR SPECTRUM WAVE-LENGTHS*

| Wave length           | Substance            | Intensity and Character | Wave length           | Substance                     | Intensity and Character |
|-----------------------|----------------------|-------------------------|-----------------------|-------------------------------|-------------------------|
| 4383 535              | Fe                   | 000 N                   | 4390 790              | Fe<br>Ti <sup>+</sup>         | 0                       |
| 4383 720 s            |                      | 15                      | 4390 932              |                               | 00 N                    |
| 4383 879              |                      | 000 N                   | 4391 002              |                               | 0000                    |
| 4383 990              |                      | 000 N                   | 4391 123 } s          |                               | 2                       |
| 4384 122              |                      | 000 N                   | 4391 192 }            |                               | 1                       |
| 4384 284              |                      | 0 N                     | 4391 306              |                               | 000                     |
| 4384 477              |                      | 1                       | 4391 462              |                               | 00                      |
| 4384 698              | Ni                   | 0                       | 4391 642              |                               | 00                      |
| 4384 873 <sup>+</sup> | V <sup>+</sup>       | 3                       | 4391 824              | SoCe <sup>+</sup>             | 0                       |
| 4384 986              | Cr                   | 0                       | 4391 924              | Cr                            | 1                       |
| 4385 144              | La <sup>+</sup> - Fe | 2                       | 4392 034              | Co                            | 0                       |
| 4385 286              |                      | 1                       | 4392 235              | V?                            | 1 N                     |
| 4385 406              | Fe <sup>+</sup>      | 1                       | 4392 470              | Fe?                           | 00 N                    |
| 4385 548              |                      | 2                       | 4392 591              |                               | 000 N                   |
| 4385 767              |                      | 00                      | 4392 752              |                               | 1                       |
| 4385 833              |                      | 00                      | 4392 947              |                               | 00 N                    |
| 4386 016              |                      | 00 N                    | 4393 085              |                               | 00                      |
| 4386 221              |                      | 0 N                     | 4393 196              | V?                            | 0                       |
| 4386 433              |                      | 0000 N d?               | 4393 442              |                               | 0                       |
| 4386 616              |                      | 0                       | 4393 686              |                               | 1 N d?                  |
| 4386 750              |                      | 00                      | 4393 858              |                               | 0                       |
| 4386 855              | Ti <sup>+</sup>      | 00 N                    | 4393 974              | V?                            | 0                       |
| 4387 007              |                      | 1                       | 4394 093              | Ti                            | 0                       |
| 4387 220              |                      | 1 N                     | 4394 225              | <del>Ti</del> Ti <sup>+</sup> | 2                       |
| 4387 420              |                      | 000 N                   | 4394 342              |                               | 00                      |
| 4387 559              | Cr                   | 0                       | 4394 463              |                               | 000                     |
| 4387 658 }            |                      | 0                       | 4394 782              |                               | 000                     |
| 4387 762 }            |                      | 0                       | 4394 943              |                               | 00                      |
| 4387 906              |                      | 000                     | 4395 020              | Zr                            | 00                      |
| 4388 057              | Fe, Co               | 2                       | 4395 201              | Ti <sup>+</sup>               | 3                       |
| 4388 260              | Mn                   | 00 N d?                 | 4395 413 <sup>a</sup> | V, Zr                         | 2                       |
| 4388 411              |                      | 00 N                    | 4395 448              |                               | 00                      |
| 4388 571              | Fe                   | 3                       | 4395 665              | Fe                            | 0                       |
| 4388 746              |                      | 00 N                    | 4395 843              | Ti <sup>+</sup>               | 000 N                   |
| 4388 887              |                      | 0                       | 4396 008              |                               | 1                       |
| 4389 029              |                      | 0 N                     | 4396 224              |                               | 00                      |
| 4389 190              |                      | 000                     | 4396 312              |                               | 00                      |
| 4389 247              |                      | 00                      | 4396 471              |                               | 0                       |
| 4389 413              | Fe <sup>+</sup>      | 2                       | 4396 592              |                               | 00                      |
| 4389 555              |                      | 000                     | 4396 790              |                               | 00 N                    |
| 4389 667              |                      | 0 N                     | 4396 931              |                               | 000                     |
| 4389 801              |                      | 0                       | 4397 125              |                               | 1 N                     |
| 4389 930              | Mn, Ni?              | 0                       | 4397 306              |                               | 00                      |
| 4390 034              |                      | 00                      | 4397 428              |                               | 00                      |
| 4390 149 <sup>a</sup> | V                    | 2                       | 4397 550              |                               | 00                      |
| 4390 273              |                      | 000                     | 4397 742              |                               | 000 N                   |
| 4390 379              | Ni                   | 00                      | 4397 952              |                               | 00 N d?                 |
| 4390 496              |                      | 00                      | 4398 178              | 3 Y <sup>+</sup>              | 1                       |
| 4390 617              | Fe?                  | 1                       | 4398 334              |                               | 00                      |
| 4390 699              |                      | 0                       | 4398 460              | Ti <sup>+</sup>               | 0                       |

<sup>+</sup>The strongest Vanadium lines in the whole solar spectrum or in this part, if not the whole, of the Vanadium spectrum

<sup>a</sup>Very strong Vanadium lines

<sup>3</sup>In Zircon but not in Zr

| Wave length           | Substance          | Intensity and Character | Wave length           | Substance             | Intensity and Character |
|-----------------------|--------------------|-------------------------|-----------------------|-----------------------|-------------------------|
| 4398 651              |                    | o N                     | 4406 997              |                       | oo                      |
| 4398 784              |                    | oo                      | 4407 155              |                       | oo                      |
| 4398 879              |                    | oo                      | 4407 297              |                       | ooo                     |
| 4399 010              |                    | oo                      | 4407 432              |                       | o N                     |
| 4399 230              |                    | oo N                    | 4407 533              |                       | oo N                    |
| 4399 379              |                    | oo                      | 4407 680              |                       | ooo                     |
| 4399 451              | <del>Ni</del> Ni   | o                       | 4407 810 } s          | V <sup>++</sup>       | 2                       |
| 4399 640              |                    | oo                      | 4407 871 }            | Fe                    | 4                       |
| 4399 776              | Ni                 | o                       | 4408 022              |                       | ooo                     |
| 4399 935              | Ti <sup>+</sup> Cr | 3                       | 4408 096              |                       | oo                      |
| 4400 149              |                    | oo N                    | 4408 236              |                       | ooo                     |
| 4400 343              | Zr                 | o N d?                  | 4408 364 <sup>*</sup> | V                     | 2                       |
| 4400 555              | Sc <sup>+</sup>    | 3                       | 4408 582              | Fe                    | 3                       |
| 4400 738              | V                  | 1                       | 4408 683 <sup>*</sup> | V                     | 2                       |
| 4400 844              |                    | ooo                     | 4408 818              |                       | oo                      |
| 4401 020              | Ni                 | o N                     | 4408 956              |                       | oo N                    |
| 4401 183              |                    | 1 N                     | 4409 096              |                       | oo N                    |
| 4401 241              |                    | ooo                     | 4409 288              | Fe?                   | 1                       |
| 4401 456              | Fe                 | 2                       | 4409 408              |                       | o                       |
| 4401 613              | Fe                 | 1                       | 4409 525              |                       | oo N                    |
| 4401 709              | Ni                 | 2                       | 4409 683              | Ti <sup>+</sup>       | 1                       |
| 4401 828              |                    | ooo                     | 4409 853              |                       | ooo N                   |
| 4402 509              |                    | oo N                    | 4410 015              |                       | ooo N                   |
| 4402 640              |                    | oo N                    | 4410 168              |                       | o N                     |
| 4402 843              |                    | ooo N                   | 4410 328              |                       | oo N                    |
| 4403 111              |                    | oo N                    | 4410 463              | Cr                    | oo N                    |
| 4403 241              |                    | oo                      | 4410 683              | Ni                    | 2                       |
| 4403 347              |                    | 1                       | 4410 817              |                       | ooo                     |
| 4403 532              | Cr, Zr             | o                       | 4410 923              |                       | oooo                    |
| 4403 661              | Cr                 | oo                      | 4411 019              |                       | oo                      |
| 4403 815              |                    | oo N                    | 4411 111              |                       | ooo                     |
| 4403 990              |                    | oo N                    | 4411 240              | Ti <sup>+</sup> -NiCr | 1                       |
| 4404 131              |                    | o                       | 4411 385              |                       | oo N                    |
| 4404 261              |                    | oo                      | 4411 748              |                       | oo N                    |
| 4404 433              | Ti                 | 1 N                     | 4411 882              |                       | oo N                    |
| 4404 563              |                    | oo                      | 4412 043              | Mn                    | ooo                     |
| 4404 706              |                    | oo N                    | 4412 092              | Ti <sup>+</sup>       | 1                       |
| 4404 757              |                    | oo N                    | 4412 297              | V                     | oo                      |
| 4404 927 s            | Fe                 | 10                      | 4412 415              | Cr                    | o                       |
| 4405 082              |                    | oo                      | 4412 581              |                       | oo N                    |
| 4405 191              |                    | 1                       | 4412 861              |                       | oo N                    |
| 4405 472              |                    | ooo                     | 4413 042              |                       | oo N                    |
| 4405 576              |                    | oo                      | 4413 280              | Zr                    | oo N                    |
| 4405 728              |                    | oo N                    | 4413 560              |                       | oo N                    |
| 4405 896              |                    | o N d?                  | 4413 756              |                       | 1                       |
| 4406 201              |                    | oo                      | 4413 944              |                       | ooo                     |
| 4406 319              |                    | o                       | 4414.011              | Cr                    | o                       |
| 4406 456              |                    | ooo                     | 4414 207              |                       | ooo                     |
| 4406 662              |                    | oo                      | 4414 278              |                       | oo                      |
| 4406 810 <sup>*</sup> | V-                 | 2                       | 4414 391              |                       | oo                      |

\* Very strong Vanadium lines

# PRELIMINARY TABLE OF SOLAR SPECTRUM WAVE-LENGTHS V

By HENRY A ROWLAND

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 4414 621    |           | 00                      | 4420 832    |           | 00                      |
| 4414 714    | Zn        | 00                      | 4421 090    |           | 000                     |
| 4414 896    |           | 000                     | 4421 290    |           | 00 N                    |
| 4415 047    | Mn        | 2                       | 4421 495    |           | 00                      |
| 4415 199    |           | { 000 N                 | 4421 616    |           | 00                      |
| 4415 293    | Fe        | 8                       | 4421 733    | V         | 0                       |
| 4415 414    |           | { 000 N                 | 4421 928    | Ti        | 00                      |
| 4415 586    |           | 000                     | 4422 104    | Ti+       | 1                       |
| 4415 722    | Sn+       | 3                       | 4422 226    |           | 0                       |
| 4415 945    |           | 00 N                    | 4422 461    |           | 00 N d                  |
| 4416 074    |           | 000                     | 4422 666    |           | 00                      |
| 4416 224    |           | 00                      | 4422 741    | Fe, V+    | 3                       |
| 4416 319    |           | 00                      | 4422 872    |           | 000                     |
| 4416 517    |           | 00 N                    | 4422 985    | Ti        | 0                       |
| 4416 636    | V         | 0                       | 4423 134    |           | 0 d?                    |
| 4416 811    |           | 00 N                    | 4423 298    | Fe        | 1                       |
| 4416 985    | A Fe Fe+  | 2                       | 4423 430    | Cr        | 0 N                     |
| 4417 163    |           | 000                     | 4423 630    |           | 000                     |
| 4417 275    |           | 00 N                    | 4423 747    |           | 000                     |
| 4417 450    | Ti        | 0                       | 4423 843    |           | 000                     |
| 4417 577    | Co        | 00                      | 4424 006    | Fe?       | 2                       |
| 4417 740    |           | 00                      | 4424 133    |           | 0                       |
| 4417 884    | Zr-Ti+    | 3                       | 4424 368    |           | 00                      |
| 4418 044    |           | 000                     | 4424 457    | Cr        | 0                       |
| 4418 199    |           | 00 N                    | 4424 531    | Sn+       | 00                      |
| 4418 366    |           | 000                     | 4424 748    |           | 0 N d?                  |
| 4418 499    | Ti+       | 1                       | 4424 975    |           | 00 N d?                 |
| 4418 590    |           | 00                      | 4425 321    |           | 000 N                   |
| 4418 734    |           | 00 d?                   | 4425 608    | Ca        | 4                       |
| 4418 944    |           | 00 N                    | 4425 827    |           | 00                      |
| 4419 106    |           | 00 N                    | 4425 931    |           | 00 N                    |
| 4419 265    |           | 00 N                    | 4426 121    |           | 000                     |
| 4419 440    |           | 00 N                    | 4426 201    | Ti        | 0 N d?                  |
| 4419 675    |           | 00                      | 4426 536    |           | 000                     |
| 4419 768    |           | 000                     | 4426 617    |           | 000                     |
| 4419 944    | Mn        | 00 N                    | 4426 839    |           | 000 Nd?                 |
| 4420 100    | V         | 00 N                    | 4427 054    |           | 000 Nd?                 |
| 4420 266    |           | 00 N                    | 4427 266    | Ti        | 2                       |
| 4420 447    |           | 0                       | 4427 482    | Fe        | 5                       |
| 4420 686    | Zr        | 00                      | 4427 623    |           | 0000                    |

| Wave length | Substance       | Intensity and Character | Wave length | Substance       | Intensity and Character |
|-------------|-----------------|-------------------------|-------------|-----------------|-------------------------|
| 4427 760    | La              | 000                     | 4436 000    |                 | 0000                    |
| 4427 875    | La              | 0000                    | 4436 162    |                 | 000 N                   |
| 4428 083    |                 | 00 N                    | 4436 313    | V               | 0                       |
| 4428 256    |                 | 00 N                    | 4436 516    | Mn              | 2                       |
| 4428 438    |                 | 00 N                    | 4436 750    |                 | 00                      |
| 4428 711    | V-Cr            | 1 d?                    | 4436 852    |                 | 00                      |
| 4428 873    |                 | 00                      | 4436 949    |                 | 00                      |
| 4429 077    |                 | 000                     | 4437 112    | Fe-Ni           | 2 d?                    |
| 4429 366    |                 | 00                      | 4437 297    |                 | 000 N                   |
| 4429 456    |                 | 00                      | 4437 429    |                 | 000 N                   |
| 4429 664    |                 | 000 N                   | 4437 589    |                 | 000 N                   |
| 4429 804    |                 | 000 N                   | 4437 729    |                 | 0                       |
| 4429 958    | V               | 00                      | 4437 862    |                 | 00                      |
| 4430 070    | La              | 00 N                    | 4438 006    | V               | 0                       |
| 4430 221    | La              | 00 N                    | 4438 192    |                 | 00                      |
| 4430 356    | Fe              | 1                       | 4438 359    | Sr, Zl, Ti      | 00 Nd?                  |
| 4430 524    |                 | 00                      | 4438 510    | Fe              | 1                       |
| 4430 646    |                 | 00                      | 4438 687    |                 | 00 N                    |
| 4430 785    | Fe              | 3                       | 4438 790    |                 | 00                      |
| 4430 929    |                 | 0                       | 4438 953    |                 | 0000                    |
| 4431 302    |                 | 0 N                     | 4439 127    |                 | 0000                    |
| 4431 453    |                 | 000                     | 4439 332    |                 | 0 N d?                  |
| 4431 525    | Sc <sup>+</sup> | 0                       | 4439 521    |                 | 00                      |
| 4431 660    |                 | 000                     | 4439 649    |                 | 0000                    |
| 4431 785    |                 | 00                      | 4439 806    |                 | 0                       |
| 4432 009    |                 | 0                       | 4439 911    |                 | 000                     |
| 4432 247    |                 | 00                      | 4440 054    | Fe              | 1                       |
| 4432 330    | Cr              | 0                       | 4440 231    |                 | 000 N                   |
| 4432 477    |                 | 0000                    | 4440 342    | Fe              | 00 Nd?                  |
| 4432 587    |                 | 000                     | 4440 515    | Ti              | 00                      |
| 4432 736    | Fe              | 1                       | 4440 635    | Zr-             | 1                       |
| 4432 904    |                 | 00 N                    | 4440 787    |                 | 00 N                    |
| 4433 089    |                 | 000 N                   | 4440 989    |                 | 1                       |
| 4433 208    |                 | 00 N                    | 4441 151    | Fe              | 0                       |
| 4433 390    | Fe              | 3                       | 4441 255    |                 | 0                       |
| 4433 554    |                 | 00                      | 4441 433    | Ti              | 00                      |
| 4433 742    |                 | 00 N                    | 4441 591    |                 | 00                      |
| 4433 948    | Fe              | 1                       | 4441 718    |                 | 00                      |
| 4434 057    |                 | 000                     | 4441 881    | V-              | 3 N d?                  |
| 4434 168    | Ti              | 0 N d?                  | 4442 127    |                 | 00 N                    |
| 4434 361    |                 | 000 N                   | 4442 241    |                 | 000                     |
| 4434 504    |                 | 00                      | 4442 421    |                 | 000                     |
| 4434 605    |                 | 0                       | 4442 510    | Fe              | 6                       |
| 4434 810    |                 | 00 N                    | 4442 579    |                 | 000                     |
| 4434 918    |                 | 000                     | 4442 751    |                 | 0000                    |
| 4435 129 s  | Ca              | 5                       | 4442 842    |                 | 000                     |
| 4435 321    | Fe              | 2                       | 4442 996    | Fe              | 1                       |
| 4435 493    |                 | 00 N                    | 4443 161    | Zr <sup>+</sup> | 0                       |
| 4435 605    |                 | 00 N                    | 4443 365    | Fe              | 3                       |
| 4435 851 s  | Ca              | 4                       | 4443 459    |                 | 000                     |

## 56 TABLE OF SOLAR SPECTRUM WAVE-LENGTHS

| Wave length | Substance                     | Intensity and Character | Wave length | Substance      | Intensity and Character |
|-------------|-------------------------------|-------------------------|-------------|----------------|-------------------------|
| 4443 723    |                               | 000 N                   | 4452 903    |                | 00                      |
| 4443 976    | Ti <sup>+</sup>               | 5                       | 4452 967    |                | 00                      |
| 4444 133    |                               | 0000                    | 4453 171    | Mn             | 1                       |
| 4444 243    |                               | 000                     | 4453 328    |                | 00                      |
| 4444 385    | V Ti <sup>+</sup>             | 0                       | 4453 486    | Ti             | 2                       |
| 4444 566    | <del>Ti</del> Ti <sup>+</sup> | 00                      | 4453 692    |                | 00 N                    |
| 4444 728    |                               | 2                       | 4453 876    | I <sub>1</sub> | 1                       |
| 4444 862    |                               | 00                      | 4454 004    |                | 000                     |
| 4445 228    |                               | 000 N d?                | 4454 164    |                | 000                     |
| 4445 479    |                               | 000 N                   | 4454 274    |                | 000                     |
| 4445 641    | Fe                            | 1                       | 4454 387    |                | 000                     |
| 4445 844    |                               | 00 N d?                 | 4454 552    | Fe             | 3                       |
| 4446 019    |                               | 000 N                   | 4454 700    |                | 000                     |
| 4446 238    |                               | 0000 N                  | 4454 836    |                | 00                      |
| 4446 409    |                               | 00                      | 4454 953 s  | Ca, Zr         | 5                       |
| 4446 566    |                               | 00                      | 4455 193    | Mn             | 1                       |
| 4446 704    |                               | 0000                    | 4455 342    |                | 000                     |
| 4446 795    |                               | 000                     | 4455 485    | Mn, Ti         | 2                       |
| 4447 008    | Fe                            | 2                       | 4455 615    |                | 000 N                   |
| 4447 052    |                               | 0000                    | 4455 710    |                | 000 N                   |
| 4447 190    |                               | 0000                    | 4455 815    |                | 000 N                   |
| 4447 302    | Mn, Fe                        | 2                       | 4455 980    | Mn             | 2                       |
| 4447 519    |                               | 00 N d?                 | 4456 064 s  | Ca             | 3                       |
| 4447 718    |                               | 000 N                   | 4456 225    |                | 000                     |
| 4447 892 s  | Fe                            | 6                       | 4456 338    |                | 000                     |
| 4447 952    |                               | 00                      | 4456 497    | Fe             | 1                       |
| 4448 184    |                               | 000 N                   | 4456 625    |                | 000 N                   |
| 4448 455    |                               | 000 N                   | 4456 794 s  | Ca             | 2                       |
| 4448 607    |                               | 000 N                   | 4456 945    |                | 000                     |
| 4449 111    |                               | 00 N                    | 4457 040    |                | 000                     |
| 4449 313    | Ti                            | 2                       | 4457 207    | Mn             | 0                       |
| 4449 507    |                               | 00                      | 4457 330    |                | 000                     |
| 4449 630    |                               | 00                      | 4457 435    |                | 00                      |
| 4449 882    |                               | 00                      | 4457 600    | Ti, V, Zr      | 2                       |
| 4450 093    |                               | 00 N d?                 | 4457 712    | Mn             | 2                       |
| 4450 267    |                               | 00 N                    | 4457 835    |                | 0000                    |
| 4450 398    |                               | 000                     | 4457 940    | V              | 00 N                    |
| 4450 482    | Zr Fe                         | 1                       | 4458 110    |                | 000                     |
| 4450 654    | Ti <sup>+</sup>               | 2                       | 4458 239    | Fe?            | 2                       |
| 4450 794    |                               | 000                     | 4458 409    | Mn             | 2                       |
| 4450 925    |                               | 00                      | 4458 550    |                | 000                     |
| 4451 087    | Ti                            | 1                       | 4458 690    | Cr             | 0                       |
| 4451 279    |                               | 000 N                   | 4458 850    |                | 000                     |
| 4451 521    |                               | 000 N d?                | 4459 003    |                | 00 N                    |
| 4451 752    | Mn                            | 3                       | 4459 199    | Ni             | 2                       |
| 4451 997    |                               | 000 N                   | 4459 301    | Fe             | 3                       |
| 4452 171    | V                             | 0 N                     | 4459 525    | Fe, Cr         | 1                       |
| 4452 311    |                               | 0000                    | 4459 670    |                | 000 N                   |
| 4452 488    |                               | 000                     | 4459 779    |                | 000                     |
| 4452 782    |                               | 0                       | 4459 922    | V              | 1                       |



| Wave length | Substance  | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|------------|-------------------------|-------------|-----------|-------------------------|
| 4460 063    |            | 000                     | 4467 017    |           | 000                     |
| 4460 164    |            | 000 N                   | 4467 102    | Co Zr     | I                       |
| 4460 276    |            | 000                     | 4467 248    |           | 000                     |
| 4460 389    | V          | 0                       | 4467 373    |           | 000                     |
| 4460 462    | Mn         | I                       | 4467 498    |           | 00                      |
| 4460 525    |            | 0                       | 4467 603    |           | 0000                    |
| 4460 700    |            | 00 N d?                 | 4467 721    | Cr        | 00 N                    |
| 4460 944    |            | 00                      | 4467 997    |           | 00 Nd?                  |
| 4461 093    |            | 000 N                   | 4468 160    |           | 00 N                    |
| 4461 242    | Mn         | I                       | 4468 317    |           | 000 N                   |
| 4461 365    | Fe, Zr, Ni | I                       | 4468 463    |           | 00 N                    |
| 4461 545    | Fe         | 0                       | 4468 663    | Ti        | 5                       |
| 4461 592    |            | 00                      | 4468 800    |           | 000                     |
| 4461 818    | Fe         | 4                       | 4468 914    |           | 000 N                   |
| 4461 983    |            | 000 N                   | 4469 150    |           | 00 N                    |
| 4462 165    | Fe Mn      | 3 N d?                  | 4469 316    | Ti        | I                       |
| 4462 365    |            | 0                       | 4469 441    |           | 0000                    |
| 4462 525    | V          | 00                      | 4469 545    | Fe        | 4                       |
| 4462 621    | Ni         | I                       | 4469 731    | Co        | 0 d?                    |
| 4462 750    |            | 0000                    | 4469 873    | V         | 00                      |
| 4462 860    |            | 00                      | 4469 971    |           | 0000                    |
| 4462 933    |            | 00                      | 4470 100    |           | 000                     |
| 4463 060    |            | 000                     | 4470 300    | Mn        | I                       |
| 4463 152    |            | 00                      | 4470 477    |           | 000 N                   |
| 4463 300    |            | 00                      | 4470 648    | Ni-Zr     | 2                       |
| 4463 425    |            | 00 N                    | 4470 799    |           | 000                     |
| 4463 569    | Ti-Ni      | 0                       | 4470 875    |           | 000                     |
| 4463 698    |            | 00                      | 4471 017    | Ti        | I                       |
| 4463 843    | Ti         | 0000                    | 4471 166    |           | 000                     |
| 4463 997    |            | 0000 N                  | 4471 250    |           | 000                     |
| 4464 138    |            | 0000                    | 4471 408    | Ti        | 0                       |
| 4464 389    |            | 000                     | 4471 571    |           | 000                     |
| 4464 503    |            | 000                     | 4471 724    |           | 00 N                    |
| 4464 617    | Ti?        | 2                       | 4471 846    |           | 0                       |
| 4464 844    | Mn         | 2                       | 4471 971    |           | 00                      |
| 4464 938    |            | I                       | 4472 076    |           | 0000                    |
| 4465 069    |            | 00                      | 4472 241    |           | 000                     |
| 4465 143    |            | 00                      | 4472 371    |           | 000                     |
| 4465 295    |            | 00 N                    | 4472 578    |           | 00 N                    |
| 4465 385    |            | 000 N                   | 4472 705    |           | 00 N                    |
| 4465 519    | Cr         | 0                       | 4472 884    | Fe        | I                       |
| 4465 667    |            | 000                     | 4472 967    | Mn        | 0                       |
| 4465 775    |            | 00 N                    | 4473 095    | Ni?       | 0                       |
| 4465 975    | Ti         | I                       | 4473 300    |           | 000                     |
| 4466 147    |            | 00 N                    | 4473 385    |           | 000                     |
| 4466 333    |            | 00 N                    | 4473 550    |           | 000                     |
| 4466 415    |            | 000                     | 4473 633    |           | 000                     |
| 4466 548    | Ni         | 0                       | 4473 798    |           | 000                     |
| 4466 727    | Fe         | 5                       | 4473 927    |           | 00                      |
| 4466 886    |            | 000                     | 4474 001    |           | 00                      |

| Wave-length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 4474 213    |           | 00                      | 4482 170    |           | 000 N                   |
| 4474 333    |           | 000                     | 4482 338    | —, Fe     | 5                       |
| 4474 566    |           | 00                      | 4482 438    | Fe        | 3                       |
| 4474 737    |           | 00                      | 4482 603    |           | 0000                    |
| 4474 912    |           | 00                      | 4482 704    |           | 000 N                   |
| 4475 026    | Ti        | 0                       | 4482 904    | Ti-Fe     | 1                       |
| 4475 175    |           | 000                     | 4483 039    | Cr        | 00                      |
| 4475 260    |           | 000                     | 4483 193    |           | 0000                    |
| 4475 335    |           | 0000                    | 4483 346    |           | 0000                    |
| 4475 470    | Cr        | 00                      | 4483 513    |           | 0000                    |
| 4475 633    |           | 000 N                   | 4483 706    |           | 0000                    |
| 4475 886    |           | 000 N                   | 4483 825    |           | 0000                    |
| 4476 185    | Fe        | 4                       | 4483 942    |           | 0                       |
| 4476 253    | Ag        | 3                       | 4484 078    | Co        | 0                       |
| 4476 399    |           | 0000                    | 4484 250    |           | 000                     |
| 4476 596    |           | 000                     | 4484 392    | Fe        | 4                       |
| 4476 804    |           | 000                     | 4484 555    |           | 000                     |
| 4477 028    |           | 000                     | 4484 667    |           | 00                      |
| 4477 228    |           | 00                      | 4484 859    |           | 000                     |
| 4477 397    |           | 000 Nd?                 | 4484 993    |           | 000                     |
| 4477 635    |           | 00 N                    | 4485 122    |           | 000                     |
| 4477 810    |           | 000 Nd?                 | 4485 244    |           | 000                     |
| 4478 015    |           | 000 N                   | 4485 373    |           | 000                     |
| 4478 190    |           | 0                       | 4485 586    |           | 000                     |
| 4478 306    |           | 000                     | 4485 701    |           | 000                     |
| 4478 486    | Fe Co     | 00 N                    | 4485 846    | Fe        | 3                       |
| 4478 792    |           | 00 N                    | 4486 003    |           | 000                     |
| 4478 982    |           | 00 N                    | 4486 140    |           | 0                       |
| 4479 163    |           | 00 N                    | 4486 286    |           | 000 N                   |
| 4479 404    |           | 00                      | 4486 387    |           | 000 N                   |
| 4479 553    | Mn        | 0                       | 4486 488    |           | 000 N                   |
| 4479 775    | Fe        | 1                       | 4486 762    |           | 00 N                    |
| 4479 879    | Ti        | 00                      | 4486 914    |           | 000                     |
| 4480 015    |           | 000 N                   | 4487 076    |           | 0                       |
| 4480 133    |           | 0                       | 4487 168    |           | 00                      |
| 4480 308    | Fe        | 1                       | 4487 420    |           | 00                      |
| 4480 440    |           | 00                      | 4487 530    |           | 00                      |
| 4480 548    |           | 000                     | 4487 685    |           | 00                      |
| 4480 633    |           | 0000                    | 4487 916    |           | 0                       |
| 4480 752    | Ti, Ni    | 0 N                     | 4488 034    |           | 00                      |
| 4480 868    |           | 0000                    | 4488 108    |           | 000                     |
| 4480 990    |           | 0                       | 4488 218    | Fe-Cr     | 0                       |
| 4481 195    |           | 00                      | 4488 305    |           | 1                       |
| 4481 298    |           | 0                       | 4488 493    |           | 1                       |
| 4481 438    | Ti        | 1                       | 4488 687    |           | 000 N                   |
| 4481 515    |           | 0                       | 4488 852    |           | 000                     |
| 4481 647    |           | 0000 N                  | 4488 928    | V         | 0000                    |
| 4481 782    | Fe        | 1                       | 4489 075    | Fe        | 1                       |
| 4481 940    |           | 000 N                   | 4489 262    | Ti        | 0                       |
| 4482 078    |           | 000 N                   | 4489 351    |           | 2                       |

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 4489 505    |           | 00                      | 4497 268    |           | 000                     |
| 4489 630    | Cr        | 0                       | 4497 429    |           | 000                     |
| 4489 766    |           | 00                      | 4497 571    |           | 000                     |
| 4489 911    | Fe        | 4                       | 4497 842    | Li        | 0 N                     |
| 4490 092    |           | 000                     | 4498 030    |           | 000                     |
| 4490 253    | Mn Fe     | 3 N                     | 4498 265    |           | 000                     |
| 4490 398    |           | 00                      | 4498 467    |           | 00 N                    |
| 4490 561    |           | 000                     | 4498 725    |           | 00 N                    |
| 4490 701    | Ni        | 0                       | 4498 897    | Cl        | 0                       |
| 4490 778    |           | 00                      | 4499 066 s  | Mn        | 1                       |
| 4490 942    | Fe        | 2                       | 4499 201    |           | 0000                    |
| 4490 975    |           | 0                       | 4499 310 s  |           | 1                       |
| 4491 113    |           | 0000                    | 4499 525    |           | 000 N                   |
| 4491 272    |           | 000                     | 4499 666    |           | 000                     |
| 4491 377    |           | 000                     | 4499 881    |           | 0000                    |
| 4491 570    |           | 2                       | 4500 122    | Mn        | 000                     |
| 4491 823    | Cr-Mn     | 0                       | 4500 451    | Cr        | 0                       |
| 4492 016    | Cr        | 00                      | 4500 537    |           | 00                      |
| 4492 139    |           | 000                     | 4500 669    |           | 000                     |
| 4492 278    |           | 000                     | 4500 807    |           | 00                      |
| 4492 475    | Cr, Fe    | 0                       | 4500 932    |           | 000                     |
| 4492 700    |           | 00                      | 4501 114    |           | 000                     |
| 4492 846    |           | 1                       | 4501 264    | Cr, Mn    | 0                       |
| 4493 016    |           | 0000                    | 4501 448 s  | Li,       | 5                       |
| 4493 132    |           | 000                     | 4501 622    |           | 00 N                    |
| 4493 391    |           | 000                     | 4501 813    |           | 00 N                    |
| 4493 543    |           | 00                      | 4501 946    |           | 0 N d?                  |
| 4493 695    |           | 1                       | 4502 157    |           | 00 N                    |
| 4493 917    |           | 00 N d?                 | 4502 217    |           | 0000                    |
| 4494 118    |           | 0                       | 4502 388    | Mn        | 2                       |
| 4494 222    |           | 1                       | 4502 603    |           | 00                      |
| 4494 356    |           | 00 N                    | 4502 764    | Fe?       | 0                       |
| 4494 548    |           | 00                      | 4502 925    |           | 000                     |
| 4494 656    |           | 00                      | 4503 046    |           | 0000                    |
| 4494 738 s  | Fe        | 6                       | 4503 228    |           | 000                     |
| 4494 903    |           | 000                     | 4503 476    |           | 000                     |
| 4495 031    |           | 000                     | 4503 519    |           | 000                     |
| 4495 182    | Ti        | 00                      | 4503 654    |           | 000                     |
| 4495 426    |           | 00                      | 4503 926    |           | 00                      |
| 4495 590    |           | 0 N                     | 4504 042    | Mn        | 00                      |
| 4495 738    |           | 0                       | 4504 224    |           | 0000                    |
| 4495 921    |           | 000 N                   | 4504 371    |           | 000 N                   |
| 4496 125    |           | 1                       | 4504 707    |           | 0000                    |
| 4496 318    | Ti        | 1                       | 4504 898    |           | 00                      |
| 4496 409    |           | 00                      | 4505 003    | Fe        | 1                       |
| 4496 541    |           | 0000                    | 4505 196    |           | 00                      |
| 4496 676    | Mn        | 00 N                    | 4505 404    |           | 00 N                    |
| 4496 826    |           | 000                     | 4505 647    |           | 0000                    |
| 4497 023 s  | Cr        | 3                       | 4505 959    |           | 00                      |
| 4497 138    | Zr        | 0                       | 4506 092    |           | 000                     |

## 60 TABLE OF SOLAR SPECTRUM WAVE-LENGTHS

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 4506 259    | Ba?       | 00 N                    | 4514 358    | Fe, Co    | I                       |
| 4506 497    |           | 00                      | 4514 486    |           | 000                     |
| 4506 618    |           | 000                     | 4514 594    | Cr        | I                       |
| 4506 776    |           | 00                      | 4514 662    |           | 0                       |
| 4506 907    |           | 00                      | 4514 817    | h 2c      | 000                     |
| 4507 009    |           | 00                      | 4514 957    |           | 00 N                    |
| 4507 139    |           | 0000                    | 4515 134    |           | 000                     |
| 4507 266    |           | 0000                    | 4515 273    |           | 0000                    |
| 4507 396    |           | 0                       | 4515 342    |           | 0                       |
| 4507 560    |           | 00                      | 4515 508    |           | 3                       |
| 4507 711    |           | 0000                    | 4515 606    |           | 00                      |
| 4507 919    |           | 00                      | 4515 763    |           | 00 Nd?                  |
| 4508 027    |           | 00                      | 4516 037    |           | 00 N                    |
| 4508 177    |           | 00                      | 4516 255    |           | 000 N                   |
| 4508 250    |           | 00                      | 4516 437    |           | 0 N                     |
| 4508 455 s  | Fe?,-     | 4                       | 4516 628    |           | 000                     |
| 4508 638    |           | 000                     | 4516 826    |           | 0 N                     |
| 4508 716    |           | 000                     | 4517 094    |           | 000 Nd?                 |
| 4508 855    |           | 0                       | 4517 255    | Co        | 000                     |
| 4509 063    |           | 000                     | 4517 321    |           | 0                       |
| 4509 294    |           | 000                     | 4517 471    | Fe        | 0000                    |
| 4509 456    |           | 0 N                     | 4517 539    |           | 000                     |
| 4509 616    |           | 0                       | 4517 702    | Ti        | 3                       |
| 4509 758    |           | 000                     | 4517 764    |           | 000                     |
| 4509 904    |           | I                       | 4517 923    | Ti        | 000                     |
| 4510 161    | In        | 00 N                    | 4518 004    |           | 000                     |
| 4510 344    |           | 0000                    | 4518 198    | Ti        | 3                       |
| 4510 434    |           | 0000                    | 4518 349    |           | 000                     |
| 4510 708    |           | 000                     | 4518 506    | Ti        | I                       |
| 4511 000    |           | 0                       | 4518 612    |           | 00                      |
| 4511 233    |           | 00                      | 4518 753    | Ti        | 0                       |
| 4511 345    |           | 00                      | 4518 866    |           | 0                       |
| 4511 516    |           | 00 N                    | 4519 027    | Ni        | 000                     |
| 4511 728    |           | 00 N                    | 4519 148    |           | 000                     |
| 4512 063    | Cr        | I                       | 4519 465    | Fe?,-     | 000                     |
| 4512 227    |           | 00 N                    | 4519 624    |           | 0000 N                  |
| 4512 439    | Tl        | 0                       | 4519 806    | Ni        | 00                      |
| 4512 602    |           | 000                     | 4520 009    |           | 00 N                    |
| 4512 663    | Tl        | 000                     | 4520 157    | Fe?,-     | 0                       |
| 4512 732    |           | 000                     | 4520 282    |           | 000                     |
| 4512 906    | Ni        | 3                       | 4520 397    | Cr        | 3.                      |
| 4513 051    |           | 000                     | 4520 565    |           | 000                     |
| 4513 164    | Ni        | 0                       | 4520 701    |           | 00 N                    |
| 4513 385    |           | 000 N                   | 4520 970    |           | 00 N                    |
| 4513 491    |           | 000                     | 4521 132    |           | 000 N                   |
| 4513 603    |           | 0                       | 4521 304    |           | 0                       |
| 4513 754    |           | 00                      | 4521 446    |           | 000                     |
| 4513 886    |           | 00                      | 4521 598    |           | 000                     |
| 4514 038    |           | 0000                    | 4521 834    |           | 000 N                   |
| 4514 078    |           | 000                     | 4522 053    |           | 00 N                    |

| Wave length | Substance   | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-------------|-------------------------|-------------|-----------|-------------------------|
| 4522 195    |             | 00                      | 4529 849    | Fe        | 1                       |
| 4522 286    |             | 00                      | 4530 020    | Cr        | 0                       |
| 4522 418    | La          | 0000                    | 4530 172    |           | 000 N                   |
| 4522 539    |             | 00                      | 4530 275    |           | 000 N                   |
| 4522 691    | Fe?         | 0                       | 4530 506    |           | 000 N                   |
| 4522 802    | <i>h 2c</i> | 3                       | 4530 668    |           | 00 N                    |
| 4522 974    | Ti          | 2                       | 4530 866    | Cr        | 0                       |
| 4523 116    |             | 000                     | 4530 910    | Cr        | 1                       |
| 4523 250    |             | 0                       | 4531 123    | Fe?, Co   | 2                       |
| 4523 412    |             | 000 N                   | 4531 327    | Fe        | 5                       |
| 4523 572    | Mn?         | 1                       | 4531 518    |           | 0000                    |
| 4523 751    |             | 000 N                   | 4531 625    |           | 0000                    |
| 4523 910    |             | 000 N                   | 4531 801    | Fe        | 2                       |
| 4524 090    |             | 00                      | 4531 974    |           | 0000                    |
| 4524 262    |             | 00                      | 4532 075    |           | 000                     |
| 4524 393    |             | 00                      | 4532 306    |           | 000                     |
| 4524 584    |             | 0000                    | 4532 485    |           | 000 N                   |
| 4524 685    |             | 0000                    | 4532 743    |           | 000 N                   |
| 4524 856    |             | 0                       | 4532 944    |           | 00                      |
| 4525 009    |             | 00                      | 4533 133    |           | 1                       |
| 4525 110    |             | 0                       | 4533 219    |           | 0                       |
| 4525 314    | Fe          | 5                       | 4533 419    | Ii        | 4                       |
| 4525 412    |             | 000                     | 4533 583    |           | 0000                    |
| 4525 783    |             | 000 N                   | 4533 710    |           | 000 N                   |
| 4526 031    |             | 0                       | 4533 887    |           | 00 N                    |
| 4526 269    | Cr          | 0                       | 4534 139    | Ii Co     | 6                       |
| 4526 431    |             | 000                     | 4534 340    |           | 1                       |
| 4526 579    |             | 1                       | 4534 484    |           | 000                     |
| 4526 632    | Cr          | 2                       | 4534 646    |           | 000                     |
| 4526 732    | Fe          | 1                       | 4534 788    |           | 000                     |
| 4526 887    |             | 0000                    | 4534 953    | Ti        | 4                       |
| 4526 955    |             | 0000                    | 4535 152    |           | 000 Nd?                 |
| 4527 101    | Ca?         | 3                       | 4535 310    | Cr        | 0                       |
| 4527 332    |             | 000 N                   | 4535 491    |           | 00                      |
| 4527 490    | Ti          | 3                       | 4535 615    |           | 000                     |
| 4527 632    |             | 0                       | 4535 741    | Ti        | 3                       |
| 4527 807    |             | 000                     | 4535 879    | Cr        | 1                       |
| 4527 954    |             | 0                       | 4535 909    | Zi        | 0                       |
| 4528 097    |             | 000 N                   | 4536 094    | Ti        | 2                       |
| 4528 310    |             | 00 N                    | 4536 222    | Ti        | 2                       |
| 4528 473    |             | 000 N                   | 4536 377    |           | 0000                    |
| 4528 647    |             | 0 N                     | 4536 532    |           | 00                      |
| 4528 798    | Fe          | 8                       | 4536 675    |           | 00                      |
| 4528 929    |             | 0                       | 4536 853    |           | 0000                    |
| 4528 990    |             | 0                       | 4537 075    |           | 000                     |
| 4529 185    |             | 000                     | 4537 389    |           | 00 N                    |
| 4529 394    |             | 000                     | 4537 592    |           | 00                      |
| 4529 482    |             | 000                     | 4537 845    |           | 0                       |
| 4529 656    |             | 1                       | 4537 986    |           | 000                     |
| 4529 728    |             | 1                       | 4538 138    |           | 00 N                    |

62 TABLE OF SOLAR SPECTRUM WAVE-LENGTHS

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 4538 351    |           | 000 N                   | 4545 861    |           | 000                     |
| 4538 539    |           | 00                      | 4545 983    |           | 000                     |
| 4538 634    |           | 000                     | 4546 129    | Fe, Cr    | 3                       |
| 4538 770    |           | 00 N                    | 4546 276    |           | 000                     |
| 4538 928    | Fe        | 0                       | 4546 428    |           | 000 N                   |
| 4539 013    | Fe        | 0                       | 4546 645    |           | 00                      |
| 4539 124    |           | 00                      | 4546 848    |           | 00                      |
| 4539 263    |           | 00                      | 4546 975    |           | 0000                    |
| 4539 424    |           | 00                      | 4547 101    | Ni        | 1                       |
| 4539 565    |           | 000 N d?                | 4547 192    | Fe        | 2                       |
| 4539 759    |           | 00                      | 4547 401    | Ni        | 0                       |
| 4539 946    | Cr        | 0 N                     | 4547 587    |           | 000                     |
| 4540 167    |           | 00 N                    | 4547 675    |           | 000                     |
| 4540 385    |           | 00                      | 4547 815    |           | 000 N                   |
| 4540 446    |           | 0000                    | 4548 024    | Fe        | 3                       |
| 4540 575    |           | 00                      | 4548 165    |           | 0000                    |
| 4540 672    | Cr        | 2                       | 4548 301    |           | 00                      |
| 4540 880    | Cr        | 2                       | 4548 412    |           | 000                     |
| 4541 043    |           | 00                      | 4548 614    |           | 00                      |
| 4541 236    | Cr        | 0                       | 4548 756    |           | 00                      |
| 4541 352    |           | 000                     | 4548 938    | Ti        | 2                       |
| 4541 483    |           | 0                       | 4549 069    |           | 000                     |
| 4541 690    | Cl        | 2                       | 4549 187    |           | 000                     |
| 4541 823    |           | 000                     | 4549 273    |           | 000                     |
| 4541 976    |           | 000                     | 4549 360    |           | 00                      |
| 4542 113    |           | 00                      | 4549 450    |           | 00                      |
| 4542 234    |           | 000                     | 4549 642    | Fe        | 2                       |
| 4542 400    | Zr        | 0 N                     | 4549 808    | Ti Co     | 6 d?                    |
| 4542 600    | Fe        | 1 N                     | 4549 990    |           | 0                       |
| 4542 785    | Cr        | 0                       | 4550 162    |           | 000 N                   |
| 4542 876    |           | 0                       | 4550 293    |           | 0                       |
| 4543 012    |           | 0000                    | 4550 445    |           | 00                      |
| 4543 202    |           | 000                     | 4550 601    |           | 000                     |
| 4543 402    |           | 00                      | 4550 743    |           | 000                     |
| 4543 525    |           | 0000                    | 4550 942    | Fe?       | 2                       |
| 4543 900    |           | 00                      | 4551 139    |           | 000                     |
| 4543 990    | Co        | 0                       | 4551 261    |           | 000                     |
| 4544 190    |           | 1                       | 4551 399    | Ni        | 0                       |
| 4544 365    |           | 000                     | 4551 458    |           | 000                     |
| 4544 444    |           | 0000                    | 4551 691    |           | 000 N                   |
| 4544 655    |           | 00 N                    | 4551 824    |           | 0                       |
| 4544 788    | Cl        | 1                       | 4552 018    |           | 00 N d?                 |
| 4544 864    | Ti        | 3                       | 4552 314    |           | 0                       |
| 4545 008    |           | 00                      | 4552 460    |           | 0                       |
| 4545 142    |           | 00 N                    | 4552 632    | Ti        | 2                       |
| 4545 311    |           | 1                       | 4552 725    | Fe        | 1                       |
| 4545 507    | Cr-V      | 0                       | 4552 824    |           | 000                     |
| 4545 568    |           | 00                      | 4553 065    |           | 000 N                   |
| 4545 713    |           | 000                     | 4553 219    |           | 00                      |
| 4545 770    |           | 000                     | 4553 346    | Ni        | 0                       |

| Wave length             | Substance                       | Intensity<br>and<br>Character | Wave length | Substance      | Intensity<br>and<br>Character |
|-------------------------|---------------------------------|-------------------------------|-------------|----------------|-------------------------------|
| 4553 546                |                                 | 000 N d <sup>2</sup>          | 4562 541    |                | 0                             |
| 4553 796                |                                 | 0000 N                        | 4562 649    |                | 0000                          |
| 4554 009                |                                 | 0000                          | 4562 814    | T <sub>1</sub> | 00                            |
| 4554 211 <sup>2</sup> s | Ba                              | 8                             | 4563 059    |                | 000 N                         |
| 4554 423                |                                 | 0000                          | 4563 413    |                | 00                            |
| 4554 484                |                                 | 0000                          | 4563 599    | T <sub>1</sub> | 00                            |
| 4554 626                |                                 | 1                             | 4563 939 s  | T <sub>1</sub> | 4                             |
| 4554 707                |                                 | 000                           | 4564 069    |                | 00                            |
| 4554 869                |                                 | 000 N                         | 4564 203    |                | 0000                          |
| 4555 007                |                                 | 00                            | 4564 352    |                | 00 d                          |
| 4555 162                |                                 | 2                             | 4564 511    |                | 00                            |
| 4555 264                |                                 | 00                            | 4564 629    |                | 0000                          |
| 4555 468                |                                 | 00 N                          | 4564 750    |                | 00                            |
| 4555 662                | T <sub>1</sub>                  | 3                             | 4564 875    |                | 0                             |
| 4555 830                |                                 | 000                           | 4565 002    | Fe             | 0                             |
| 4555 910                |                                 | 00                            | 4565 215    |                | 000 N                         |
| 4556 063                | <del>Fe</del>                   | 3                             | 4565 296    |                | 00 N                          |
| 4556 306                | Fe Cr                           | 4                             | 4565 488    | Fe             | 0                             |
| 4556 549                |                                 | 0000 N                        | 4565 597    |                | 00                            |
| 4556 719                |                                 | 0000 N                        | 4565 688    | Cr             | 3                             |
| 4556 934                |                                 | 0000 N                        | 4565 842    | Co Fe          | 2                             |
| 4557 107                |                                 | 0                             | 4565 905    |                | 00                            |
| 4557 262                |                                 | 000                           | 4566 031    |                | 000                           |
| 4557 457                |                                 | 0 N                           | 4566 198    |                | 00 N                          |
| 4557 689                |                                 | 0000 N                        | 4566 414    |                | 00 N                          |
| 4557 927                |                                 | 00                            | 4566 555    |                | 0000                          |
| 4558 060                |                                 | 00                            | 4566 693    | Fe             | 1                             |
| 4558 162                |                                 | 0000                          | 4566 834    |                | 0000                          |
| 4558 285                |                                 | 0                             | 4567 046    | Fe             | 1                             |
| 4558 402                |                                 | 00                            | 4567 168    |                | 00                            |
| 4558 640                |                                 | 00                            | 4567 345    |                | 0000                          |
| 4558 827                | Cr?                             | 3                             | 4567 391    |                | 0000                          |
| 4558 949                |                                 | 000                           | 4567 584    |                | 00 N                          |
| 4559 106                |                                 | 0000                          | 4567 755    |                | 000                           |
| 4559 526                |                                 | 0000                          | 4567 917    |                | 0000                          |
| 4559 728                |                                 | 0000                          | 4568 221    |                | 0000                          |
| 4559 980                |                                 | 0000                          | 4568 499    |                | 0                             |
| 4560 102                | N <sub>1</sub> , F <sub>1</sub> | 0                             | 4568 777    |                | 00                            |
| 4560 266                | Fe                              | 2                             | 4568 940    | Fe             | 1                             |
| 4560 457                |                                 | 00                            | 4569 034    |                | 0                             |
| 4560 589                |                                 | 00                            | 4569 243    |                | 00 N                          |
| 4560 740                |                                 | 000                           | 4569 425    |                | 000 N                         |
| 4560 892                |                                 | 00                            | 4569 536    |                | 00 N                          |
| 4561 044                |                                 | 00                            | 4569 693    | Cr             | 00                            |
| 4561 145                |                                 | 00                            | 4569 788    | C <sub>1</sub> | 0                             |
| 4561 368                |                                 | 00 N                          | 4569 992    |                | 0000 N                        |
| 4561 591                |                                 | 1                             | 4570 199    |                | 00 N                          |
| 4561 909                |                                 | 00 N                          | 4570 559    |                | 000 N                         |
| 4562 148                |                                 | 0000 N                        | 4570 781    |                | 000 Nd?                       |
| 4562 406                |                                 | 0000                          | 4571 095    |                | 00 N                          |

\*This line is either double or reversed in the Sun. The Ba line seems to coincide with the center

64      *TABLE OF SOLAR SPECTRUM WAVE-LENGTHS*

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 4571 275 s' | Mg        | 5                       | 4580 080    |           | 000                     |
| 4571 470    |           | 000 N d?                | 4580 228    | Cr        | 3                       |
| 4571 618    |           | 0                       | 4580 326    |           | 0000                    |
| 4571 720    |           | 0000                    | 4580 463    |           | 000                     |
| 4571 849    | Cr        | 1                       | 4580 590    | V         | 1                       |
| 4571 976    |           | 00                      | 4580 762    | Fe-Ni     | 1                       |
| 4572 156 s  | Ti        | 6                       | 4580 911    |           | 000                     |
| 4572 366    |           | 000                     | 4581 055    |           | 00 N                    |
| 4572 457    |           | 00                      | 4581 221    |           | 00 N                    |
| 4572 600    |           | 0000                    | 4581 369    |           | 0                       |
| 4572 766    |           | 00                      | 4581 575    | Ca        | 4                       |
| 4573 041    |           | 0 N                     | 4581 693    | Co, Fe    | 4                       |
| 4573 231    |           | 0000                    | 4581 805    |           | 00 N                    |
| 4573 828    |           | 0000                    | 4582 007    |           | 000 Nd?                 |
| 4573 960    | Ba?       | 000                     | 4582 250    |           | 000 Nd?                 |
| 4574 168    |           | 00                      | 4582 483    |           | 0 N                     |
| 4574 396    | Fe        | 1                       | 4582 683    |           | 00 N                    |
| 4574 537    |           | 0000                    | 4582 851    |           | 000 N                   |
| 4574 658    |           | 00 N                    | 4583 011    |           | 1                       |
| 4574 739    |           | 0000                    | 4583 126    |           | 00                      |
| 4574 899    | Fe        | 2                       | 4583 296    |           | 00                      |
| 4575 075    |           | 00 N d?                 | 4583 424    |           | 000                     |
| 4575 286    |           | 00                      | 4583 587    |           | 0                       |
| 4575 402    |           | 0000                    | 4583 749    |           | 00 N                    |
| 4575 600    |           | 00 N                    | 4583 892    |           | 00                      |
| 4575 726    | Zr        | 00 N                    | 4584 018    | Fe        | 4                       |
| 4575 964    |           | 0                       | 4584 168    |           | 00                      |
| 4576 096    |           | 0000                    | 4584 269    |           | 00                      |
| 4576 268    |           | 000 N d?                | 4584 447    |           | 00 N                    |
| 4576 512    |           | 2                       | 4584 618    |           | 000                     |
| 4576 686    |           | 00                      | 4584 730    |           | 0000                    |
| 4576 769    |           | 000                     | 4584 900    | Fe        | 1                       |
| 4576 957    |           | 000                     | 4585 001    |           | 2                       |
| 4577 181    |           | 000 N d?                | 4585 118    |           | 00                      |
| 4577 356    | V         | 0                       | 4585 257    |           | 00                      |
| 4577 501    |           | 000                     | 4585 368    |           | 000                     |
| 4577 656    |           | 000 N                   | 4585 519    |           | 0                       |
| 4577 868    |           | 00                      | 4585 772    |           | 000                     |
| 4577 988    |           | 000                     | 4585 874    |           | 00                      |
| 4578 220    |           | 00 N d?                 | 4586 047    | Ca        | 4                       |
| 4578 503    |           | 00                      | 4586 155    |           | 0                       |
| 4578 732 s  | Ca        | 3                       | 4586 315    |           | 00                      |
| 4578 909 s  | V         | 00 N                    | 4586 408    | Cr        | 1                       |
| 4579 062    |           | 00 N                    | 4586 552    | V         | 1                       |
| 4579 231    |           | 00 N                    | 4586 716    |           | 000                     |
| 4579 359    |           | 000                     | 4586 896    |           | 000 N                   |
| 4579 506    |           | 0                       | 4587 169    |           | 00                      |
| 4579 684    |           | 00 N d?                 | 4587 308    | Fe        | 2                       |
| 4579 862    | Ba?       | 00                      | 4587 571    |           | 00 N d?                 |
| 4579 994    |           | 0                       | 4587 777    |           | 00 N                    |



| Wave length | Substance      | Intensity<br>and<br>Character | Wave length | Substance      | Intensity<br>and<br>Character |
|-------------|----------------|-------------------------------|-------------|----------------|-------------------------------|
| 4587 898    |                | 00                            | 4596 128    | N <sub>1</sub> | 0                             |
| 4588 052    |                | 000 N                         | 4596 245    | Fe             | 2                             |
| 4588 180    |                | 00 N                          | 4596 414    |                | 000                           |
| 4588 381 s  |                | 3                             | 4596 589    | C <sub>1</sub> | 1                             |
| 4588 574    |                | 00 N                          | 4596 753    |                | 00                            |
| 4588 697    |                | 00 N                          | 4596 857    |                | 000                           |
| 4588 859    |                | 00                            | 4597 080    | Co             | 0 N                           |
| 4589 193    |                | 00 N                          | 4597 211    |                | 00                            |
| 4589 468    |                | 00 N                          | 4597 430    |                | 0                             |
| 4589 686    |                | 000                           | 4597 560    |                | 0                             |
| 4589 912    |                | 000 N d?                      | 4597 775    |                | 000 N                         |
| 4590 126 s  |                | 3                             | 4597 929    |                | 1                             |
| 4590 246    |                | 0000                          | 4598 050    |                | 1                             |
| 4590 388    |                | 000                           | 4598 186    |                | 0000                          |
| 4590 516    |                | 000                           | 4598 303    | Fe             | 3                             |
| 4590 664    |                | 000 N                         | 4598 456    |                | 0000                          |
| 4590 851    |                | 000                           | 4598 547    |                | 00                            |
| 4590 965    |                | 0                             | 4598 612    |                | 00                            |
| 4591 117    |                | 00                            | 4598 792    |                | 000                           |
| 4591 290    |                | 00                            | 4598 918    |                | 0                             |
| 4591 421    |                | 00                            | 4599 109    |                | 000                           |
| 4591 574    | C <sub>1</sub> | 2                             | 4599 183    |                | 00                            |
| 4591 693    |                | 1                             | 4599 408    | I <sub>1</sub> | 00                            |
| 4591 911    |                | 000 N                         | 4599 618    |                | 0000                          |
| 4592 027    |                | 00 N                          | 4599 752    |                | 000                           |
| 4592 231    | C <sub>1</sub> | 1                             | 4600 018    | Fe?            | 2                             |
| 4592 393    |                | 00                            | 4600 145    |                | 000                           |
| 4592 534    |                | 00                            | 4600 279    | Cr             | 1                             |
| 4592 707    | N <sub>1</sub> | 2                             | 4600 383    |                | 00 N                          |
| 4592 840    | Fe             | 4                             | 4600 541    | N <sub>1</sub> | 2                             |
| 4592 990    |                | 0000                          | 4600 737    |                | 00 N d?                       |
| 4593 102    |                | 000                           | 4600 932    | C <sub>1</sub> | 3                             |
| 4593 355    |                | 00                            | 4601 114    |                | 0                             |
| 4593 543    |                | 000                           | 4601 207    | Cr             | 0                             |
| 4593 704    |                | 1                             | 4601 319    |                | 00                            |
| 4593 883    |                | 000                           | 4601 452    |                | 00                            |
| 4594 002    |                | 0                             | 4601 557    |                | 00                            |
| 4594 113    |                | 0                             | 4601 734    |                | 000                           |
| 4594 297    | V              | 2 N                           | 4601 917    |                | 000                           |
| 4594 459    |                | 000 N                         | 4602 013    |                | 000                           |
| 4594 590    |                | 00 N d?                       | 4602 183 s  | Fe             | 3                             |
| 4594 820    | Co             | 00 N                          | 4602 356    |                | 0000                          |
| 4594 964    |                | 0000                          | 4602 565    |                | 0000                          |
| 4595 067    | N <sub>1</sub> | 0                             | 4602 717    |                | 0000                          |
| 4595 227    |                | 00                            | 4602 929    |                | 0000                          |
| 4595 386    |                | 00                            | 4603 126    | Fe             | 6                             |
| 4595 540    | Fe             | 2                             | 4603 282    |                | 000                           |
| 4595 651    |                | 00                            | 4603 525    |                | 0                             |
| 4595 770    | C <sub>1</sub> | 0                             | 4603 665    |                | 0000                          |
| 4595 865    |                | 000                           | 4603 799    |                | 00                            |

66 *TABLE OF SOLAR SPECTRUM WAVE-LENGTHS*

| Wave length  | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|--------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 4603 902     |           | 00                      | 4612 794    |           | 00                      |
| 4604 031     |           | 0                       | 4612 925    |           | 000                     |
| 4604 137     |           | 0                       | 4613 137    |           | 00 N                    |
| 4604 420     |           | 00 N                    | 4613 386    | Fe        | 3                       |
| 4604 580     |           | 0000                    | 4613 544    | Cl, I a   | 3                       |
| 4604 735     | Fe ?      | 2                       | 4613 738    |           | 000 Nd?                 |
| 4604 863     |           | 000                     | 4613 892    |           | 00                      |
| 4605 025     |           | 00                      | 4614 097    |           | 1                       |
| 4605 171     | Ni        | 3                       | 4614 388    | Fe ?      | 1                       |
| 4605 278     |           | 000                     | 4614 529    |           | 0000                    |
| 4605 430     |           | 000 N                   | 4614 713    |           | 00                      |
| 4605 536     | Mn        | 0                       | 4614 761    |           | 00                      |
| 4605 640     |           | 00                      | 4614 914    |           | 00                      |
| 4605 769     |           | 2                       | 4615 114    |           | 0000 N                  |
| 4606 017     |           | 00 N                    | 4615 427    |           | 0000 N                  |
| 4606 189     |           | 000 N                   | 4615 632    |           | 000                     |
| 4606 404     | Ni, C     | 2                       | 4615 743    | Fe ?      | 1                       |
| 4606 574     |           | 00 N                    | 4615 896    |           | 00                      |
| 4606 687     |           | 000 N                   | 4616 114    |           | 00                      |
| 4606 969     |           | 000 N                   | 4616 305    | Cl        | 4                       |
| 4607 274     |           | 00 N                    | 4616 472    |           | 000                     |
| 4607 394     |           | 0000                    | 4616 644    |           | 00 N                    |
| 4607 510 s   | Sr        | 1                       | 4616 804    |           | 1 N                     |
| 4607 687     |           | 000 N                   | 4616 923    |           | 000                     |
| 4607 831     | Fe        | 4                       | 4617 134    |           | 000                     |
| 4608 037     |           | 000                     | 4617 244    |           | 000 N                   |
| 4608 305     |           | 000                     | 4617 452    | Li        | 3                       |
| 4608 406     |           | 0000                    | 4617 636    |           | 000 N                   |
| 4608 700     |           | 000 Nd?                 | 4618 046    |           | 00                      |
| 4608 887     |           | 00 N                    | 4618 150    |           | 00                      |
| 4609 023     |           | 0000 N                  | 4618 303    |           | 0000                    |
| 4609 447     |           | 0                       | 4618 536    |           | 00                      |
| 4609 540     |           | 000                     | 4618 688    |           | 00                      |
| 4609 752     |           | 0000 N                  | 4618 971    | Fe-       | 4 d?                    |
| 4609 833     |           | 000 N                   | 4619 133    |           | 000 N                   |
| 4610 088     |           | 0                       | 4619 285    |           | 00 N                    |
| 4610 267     |           | 0000                    | 4619 468    | Fe        | 3                       |
| 4610 365     |           | 0                       | 4619 607    |           | 0000                    |
| 4610 771     |           | 000 N                   | 4619 711    | Cr        | 1                       |
| 4611 118     |           | 000                     | 4619 852    |           | 0000                    |
| 4611 249     |           | 00                      | 4619 963    |           | 00                      |
| 4611 368 } s | Cl        | 0                       | 4620 072    |           | 0000                    |
| 4611 469 } s | Fe        | 5                       | 4620 313    |           | 00                      |
| 4611 664     |           | 000                     | 4620 522    |           | 00 N                    |
| 4611 816     |           | 00                      | 4620 693    | Fe        | 1                       |
| 4612 000     |           | 000                     | 4620 986    |           | 000 N                   |
| 4612 138     | Cr        | 00                      | 4621 208    |           | 0000                    |
| 4612 251     |           | 000                     | 4621 299    |           | 000                     |
| 4612 446     |           | 000                     | 4621 482    |           | 0000 N                  |
| 4612 646     |           | 000                     | 4621 654    |           | 00                      |

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 4621 795    |           | 00                      | 4630 306    | Fe        | 4                       |
| 4621 947    |           | 000                     | 4630 582    |           | 000 N                   |
| 4622 065    | Cr        | 0                       | 4630 740    |           | 0                       |
| 4622 128    | Cr        | 1                       | 4630 958    |           | 00 N                    |
| 4622 307    |           | 000 N                   | 4631 212    |           | 0 N                     |
| 4622 433    |           | 000 N                   | 4631 385    |           | 000                     |
| 4622 627    | Cr        | 1                       | 4631 512    |           | 0000                    |
| 4622 733    |           | 000                     | 4631 663    |           | 0                       |
| 4622 929    | Cr        | 0                       | 4631 900    |           | 00 Nd?                  |
| 4623 071    |           | 000                     | 4632 129    |           | 00 Nd?                  |
| 4623 279    | Ti        | 2                       | 4632 320    | Cr        | 0                       |
| 4623 476    |           | 00 N                    | 4632 503    |           | 00 N                    |
| 4623 759    |           | 0                       | 4632 654    |           | 00 N                    |
| 4624 053    |           | 000 N                   | 4632 825    |           | 00 N                    |
| 4624 265    |           | 00                      | 4632 991    |           | 1                       |
| 4624 443    |           | 000 N                   | 4633 100    | Fe        | 4                       |
| 4624 594    |           | 00 N                    | 4633 272    |           | 00 Nd?                  |
| 4624 741    |           | 00 N                    | 4633 432    | Cr        | 0                       |
| 4624 923    |           | 00 N                    | 4633 555    |           | 000 N                   |
| 4625 074    |           | 00 N                    | 4633 722    |           | 00 N                    |
| 4625 227    | Fe        | 5                       | 4633 950    |           | 0 N                     |
| 4625 378    |           | 000 N                   | 4634 187    |           | 0000                    |
| 4625 489    |           | 00 N                    | 4634 254    |           | 2                       |
| 4625 613    |           | 00 N                    | 4634 441    |           | 000                     |
| 4625 947    |           | 00 N                    | 4634 547    |           | 000                     |
| 4626 096    | Cr        | 0 N                     | 4634 780    |           | 000                     |
| 4626 198    |           | 000                     | 4634 895    | Fe?       | 1                       |
| 4626 358    | Cr        | 5                       | 4635 048    |           | 00                      |
| 4626 532    |           | 00 N                    | 4635 210    |           | 000                     |
| 4626 718    | Mn        | 0                       | 4635 352    | V         | 00 N                    |
| 4626 825    |           | 000                     | 4635 480    |           | 0                       |
| 4626 975    |           | 00                      | 4635 598    |           | 0000                    |
| 4627 190    |           | 000 N                   | 4635 736    |           | 00                      |
| 4627 392    |           | 00 N                    | 4635 803    |           | 0                       |
| 4627 547    |           | 0                       | 4635 884    |           | 0000                    |
| 4627 726    |           | 0                       | 4636 027    | Fe        | 2                       |
| 4627 829    |           | 0000                    | 4636 192    |           | 000 N                   |
| 4628 032    |           | 0000                    | 4636 339    |           | 00 N                    |
| 4628 197    |           | 0000                    | 4636 501    |           | 0                       |
| 4628 335    |           | 0                       | 4636 740    |           | 0000                    |
| 4628 448    |           | 0000                    | 4636 851    |           | 00                      |
| 4628 637    | Cr        | 00                      | 4637 108    |           | 000                     |
| 4628 860    |           | 00                      | 4637 221    |           | 00                      |
| 4629 092    |           | 00 N                    | 4637 352    | Cr        | 0                       |
| 4629 248    |           | 00                      | 4637 474    |           | 00                      |
| 4629 521 s  | Ti-Co     | 6                       | 4637 685 s  | Fe        | 5                       |
| 4629 714    |           | 00 N                    | 4637 845    |           | 0000                    |
| 4629 844    |           | 000                     | 4637 938    | Cr        | 0                       |
| 4629 979    |           | 00                      | 4638 050    | Ti        | 00                      |
| 4630 125    |           | 000 Nd?                 | 4638 193 s  | Fe        | 4                       |

| Wave length           | Substance | Intensity and Character | Wave length           | Substance | Intensity and Character |
|-----------------------|-----------|-------------------------|-----------------------|-----------|-------------------------|
| 4638 709              |           | 00                      | 4648 835 <sup>s</sup> | Ni        | 4                       |
| 4638 879              |           | 00 N                    | 4649 031              | Cr        | 00                      |
| 4639 132              |           | 0                       | 4649 124              |           | 00                      |
| 4639 353              |           | 00 N                    | 4649 337              |           | 00 N                    |
| 4639 538              | Ti        | 2                       | 4649 476              |           | 000                     |
| 4639 679              | Cr        | 0                       | 4649 613              | Cr        | 0                       |
| 4639 846              | Ti        | 2                       | 4649 819              |           | 0 Nd?                   |
| 4640 119              | Ti        | 1                       | 4649 992              |           | 0                       |
| 4640 280              |           | 000                     | 4650 193              | Ti        | 0                       |
| 4640 468              |           | 1                       | 4650 296              |           | 000                     |
| 4640 681              |           | 00                      | 4650 488              |           | 0                       |
| 4640 883              |           | 0000                    | 4650 725              |           | 00                      |
| 4641 147              |           | 00 Nd?                  | 4650 985              |           | 00                      |
| 4641 390              |           | 0                       | 4651 121              |           | 00                      |
| 4641 693              |           | 000 Nd?                 | 4651 200              |           | 00                      |
| 4641 851              |           | 000                     | 4651 461              | Cr        | 4                       |
| 4641 179              |           | 00                      | 4651 685              |           | 0000 N                  |
| 4642 306              |           | 00                      | 4652 045              |           | 0000 N                  |
| 4642 424              |           | 00                      | 4652 198              |           | 0000                    |
| 4642 765              |           | 00 N                    | 4652 343              | Cr        | 5                       |
| 4643 005              |           | 00                      | 4652 447              |           | 0000                    |
| 4643 235              |           | 000 N                   | 4653 069              |           | 0000                    |
| 4643 389              |           | 00                      | 4653 216              |           | 0000                    |
| 4643 475              |           | 00                      | 4653 323              |           | 0000                    |
| 4643 645 <sup>s</sup> | Fe        | 4                       | 4653 485              |           | 000                     |
| 4643 912              |           | 00 N                    | 4653 551              |           | 00                      |
| 4644 066              |           | 000 N                   | 4653 677              |           | 00                      |
| 4644 572              |           | 00 Nd?                  | 4653 819              |           | 000                     |
| 4644 703              |           | 00                      | 4653 960              |           | 000                     |
| 4645 368              | Ti        | 0                       | 4654 077              |           | 000                     |
| 4645 483              |           | 000                     | 4654 218              |           | 000                     |
| 4645 671              |           | 0 N                     | 4654 327              |           | 0                       |
| 4645 819              |           | 000 N                   | 4654 478              |           | 00 N                    |
| 4645 965              |           | 00                      | 4654 672              | Fe        | 4                       |
| 4646 058              |           | 000                     | 4654 800              | Fe        | 5                       |
| 4646 168              |           | 000                     | 4654 912              | Cr        | 00                      |
| 4646 347              | Cr        | 5                       | 4655 419              |           | 00 N                    |
| 4646 552              |           | 0                       | 4655 634              |           | 000 Nd?                 |
| 4646 676              | Cr        | 00                      | 4655 832              |           | 0                       |
| 4646 815              |           | 1                       | 4655 967              | Li        | 0                       |
| 4646 962              | Cr        | 0                       | 4656 127              |           | 0000                    |
| 4647 145              |           | 000 N                   | 4656 228              | Ti        | 0                       |
| 4647 354              |           | 00                      | 4656 365              | Cr        | 0                       |
| 4647 454              |           | 0                       | 4656 481              |           | 000                     |
| 4647 617              | Fe        | 4                       | 4656 644              | Ti        | 3                       |
| 4647 876              |           | 000 N                   | 4656 815              |           | 000                     |
| 4648 135              |           | 1                       | 4656 992              |           | 000                     |
| 4648 297              | Cr        | 0                       | 4657 154              |           | 1                       |
| 4648 497              |           | 000                     | 4657 380              | Li?       | 2                       |
| 4648 591              |           | 000                     | 4657 554              |           | 00                      |

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 4657 625    |           | 000                     | 4666 655    | Cr        | I                       |
| 4657 766    |           | I                       | 4666 782    |           | 0                       |
| 4658 034    |           | 00 N                    | 4666 925    |           | I                       |
| 4658 217    |           | 000                     | 4667 066    |           | 00 N                    |
| 4658 343    |           | 0000                    | 4667 159    | Ni        | I                       |
| 4658 475    |           | 0                       | 4667 339    | Cr        | 00                      |
| 4658 675    |           | 00 N                    | 4667 424    |           | 0                       |
| 4658 827    |           | 00 N                    | 4667 626    | Fe        | 4                       |
| 4659 054    |           | 00 N d?                 | 4667 768    | Ti        | 3                       |
| 4659 338    |           | 000 N d?                | 4667 941    | Ni        | I                       |
| 4659 547    |           | 000 N                   | 4668 099    |           | 000                     |
| 4659 707    |           | 000 N                   | 4668 243    | Fe        | 2                       |
| 4659 940    |           | 0000 N                  | 4668 331    |           | 4                       |
| 4660 145    |           | 00 N                    | 4668 550    |           | 00 N                    |
| 4660 247    |           | 00 N                    | 4668 749    |           | I N                     |
| 4660 412    |           | 00                      | 4669 017    |           | 000 N                   |
| 4660 602    |           | 0                       | 4669 164    |           | 000 N                   |
| 4660 801    |           | 000                     | 4669 354    | Fe        | 3                       |
| 4660 902    |           | 00                      | 4669 504    | Cr        | I                       |
| 4661 083    |           | 0                       | 4669 568    |           | 000                     |
| 4661 327    |           | 00 N                    | 4669 700    |           | 000                     |
| 4661 507    |           | 00 N                    | 4669 829    |           | 00                      |
| 4661 712    |           | I                       | 4670 001    |           | 000 N                   |
| 4661 965    |           | 00 N                    | 4670 155    |           | 000 N                   |
| 4662 149    | Fe?       | I                       | 4670 346    | Ni        | I                       |
| 4662 278    |           | 000                     | 4670 590    |           | 2                       |
| 4662 390    |           | 0000                    | 4670 732    |           | 00                      |
| 4662 496    |           | 0000                    | 4670 915    |           | 000                     |
| 4662 693    |           | 0                       | 4671 080    |           | 00                      |
| 4662 930    |           | 0 N                     | 4671 222    |           | 00                      |
| 4663 354    |           | 0                       | 4671 388    |           | 000                     |
| 4663 492    | Cr        | I                       | 4671 601    |           | I                       |
| 4663 587    | Co        | 0                       | 4671 742    |           | 00                      |
| 4663 734    |           | 000                     | 4671 858    | Mn        | 0                       |
| 4663 882    |           | 0                       | 4672 087    |           | 000                     |
| 4663 999    | Cr        | I                       | 4672 209    |           | 00                      |
| 4664 139    |           | 0                       | 4672 370    |           | 000                     |
| 4664 358    |           | 00 N                    | 4672 509    |           | 3 N                     |
| 4664 497    |           | 00 N                    | 4672 710    |           | 000                     |
| 4664 720    |           | 00 N d?                 | 4672 805    |           | 000                     |
| 4664 965    | Cr        | 3                       | 4673 012    |           | I                       |
| 4665 355    |           | 00                      | 4673 144    |           | 000                     |
| 4665 430    |           | 000                     | 4673 347    | Fe        | 4                       |
| 4665 722    |           | 00                      | 4673 460    |           | I                       |
| 4665 852    |           | 000                     | 4673 617    |           | 00 N                    |
| 4665 998    |           | 000                     | 4673 818    |           | 00 N                    |
| 4666 076    | Cr        | I                       | 4673 962    |           | 00 N                    |
| 4666 279    |           | 0                       | 4674 131    |           | 0000                    |
| 4666 387    | Cr        | 0                       | 4674 275    |           | I N                     |
| 4666 526    |           | 000                     | 4674 484    |           | 0                       |

# PRELIMINARY TABLE OF SOLAR SPECTRUM WAVE-LENGTHS VI

By HENRY A. ROWLAND

| Wave length | Substance      | Intensity and Character | Wave length | Substance      | Intensity and Character |
|-------------|----------------|-------------------------|-------------|----------------|-------------------------|
| 4674 648    |                | ooo                     | 4681 223    |                | ooo                     |
| 4674 829    |                | o N                     | 4681 382    |                | oo                      |
| 4674 933    |                | o                       | 4681 482    |                | oooo                    |
| 4675 053    |                | ooo                     | 4681 646    |                | i                       |
| 4675 294    | I <sub>1</sub> | i N                     | 4681 781    |                | oooo N                  |
| 4675 453    |                | ooo                     | 4681 918    |                | ooo N                   |
| 4675 569    |                | oo                      | 4682 088    | T <sub>1</sub> | 3                       |
| 4675 785    |                | o                       | 4682 295    | Fe?            | i                       |
| 4676 019    |                | ooo                     | 4682 529    | Co             | i                       |
| 4676 188    |                | oo                      | 4682 746    | Fe?            | o                       |
| 4676 338    |                | oo                      | 4682 940    |                | ooo N                   |
| 4676 409    |                | oo                      | 4683 134    |                | ooo Nd?                 |
| 4676 531    |                | oo                      | 4683 427    |                | ooo N                   |
| 4676 713    |                | oo                      | 4683 575    |                | oo N                    |
| 4676 829    |                | ooo                     | 4683 745 s  | Fe             | 3                       |
| 4677 096    | T <sub>1</sub> | oo                      | 4683 882    |                | oooo                    |
| 4677 259    |                | oo                      | 4684 001    |                | oooo                    |
| 4677 415    |                | ooo                     | 4684 155    |                | oo                      |
| 4677 604    | T <sub>1</sub> | oo                      | 4684 392    |                | oo N                    |
| 4677 775    |                | o                       | 4684 532    |                | oo N                    |
| 4677 897    |                | ooo                     | 4684 702    |                | oooo                    |
| 4678 046    |                | ooo                     | 4684 774    | Ce             | o                       |
| 4678 170    |                | ooo                     | 4684 924    |                | ooo N                   |
| 4678 347 s  | Cd             | 3 N                     | 4685 058    |                | ooo N                   |
| 4678 593    |                | oo                      | 4685 208    |                | o                       |
| 4678 706    |                | oo                      | 4685 452    | Ca             | 2 N                     |
| 4678 798    |                | oooo                    | 4685 673    |                | ooo N                   |
| 4679 027 s  | Fe             | 6                       | 4685 870    |                | oo N                    |
| 4679 249    |                | ooo                     | 4686 028    |                | oo N                    |
| 4679 409    |                | 2 N                     | 4686 180    |                | ooo                     |
| 4679 594    |                | ooo N                   | 4686 296    |                | oooo                    |
| 4679 751    |                | oooo N                  | 4686 395 s  | Ni             | 3                       |
| 4679 995    |                | oooo                    | 4686 544    |                | ooo                     |
| 4680 157    |                | ooo                     | 4686 804    |                | oo N                    |
| 4680 317    | Zn             | i                       | 4686 924    |                | oo N                    |
| 4680 480    |                | i                       | 4687 114    |                | oo Nd?                  |
| 4680 658    | Cr             | i                       | 4687 358    |                | oo                      |
| 4680 745    |                | o                       | 4687 485    |                | o                       |
| 4680 926    |                | oo                      | 4687 568    | Fe?            | 2                       |
| 4681 037    | Cr             | o                       | 4687 712    |                | oooo                    |

| Wave length  | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|--------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 4687 850     |           | 00                      | 4696 809    |           | 00                      |
| 4687 981     | Zr        | 0                       | 4696 930    |           | 000                     |
| 4688 117     |           | 000 N                   | 4697 101    |           | 00                      |
| 4688 357     | Fe        | 2                       | 4697 230    | Cr        | 1                       |
| 4688 554     |           | 0                       | 4697 469    |           | 00                      |
| 4688 651     |           | 000                     | 4697 578    |           | 0                       |
| 4688 862     |           | 0 N                     | 4697 791    |           | 00                      |
| 4689 236     |           | 00                      | 4697 983    |           | 000                     |
| 4689 388     |           | 000                     | 4698 256    |           | 000 Nd?                 |
| 4689 540     | Cr        | 2                       | 4698 451    |           | 00                      |
| 4689 676     | Fe?       | 1                       | 4698 579    | Co        | 0                       |
| 4689 793     |           | 0000                    | 4698 641    | Cr        | 1                       |
| 4689 935     |           | 00 N                    | 4698 798    | Ci        | 1                       |
| 4690 149     |           | 000 N                   | 4698 946    | Ti        | 1                       |
| 4690 317 s   | Fe?       | 4                       | 4699 127    |           | 00                      |
| 4690 555     |           | 0                       | 4699 309    |           | 000 N                   |
| 4690 734     |           | 000                     | 4699 511    |           | 4                       |
| 4690 977     | Li        | 00                      | 4699 762    |           | 00                      |
| 4691 149     |           | 000 N                   | 4699 899    |           | 00 N                    |
| 4691 372     |           | 000                     | 4700 029    |           | 000                     |
| 4691 523 } s | Li        | 1                       | 4700 165    |           | 000                     |
| 4691 602 }   | Fe        | 5                       | 4700 337    |           | 4                       |
| 4691 777     |           | 1 N                     | 4700 473    | Fe?       | 000                     |
| 4691 954     |           | 00 N                    | 4700 614    |           | 00                      |
| 4692 144     |           | 00 N                    | 4700 795    | Ci        | 0                       |
| 4692 394     |           | 00 N                    | 4700 989    |           | 0000 N                  |
| 4692 699     |           | 00 N                    | 4701 090    |           | 00 N                    |
| 4692 829     |           | 0 N                     | 4701 231    | Fe? '1'   | 1                       |
| 4693 022     |           | 00 N                    | 4701 345    | Mn        | 00                      |
| 4693 149     |           | 000 N                   | 4701 535    |           | 1                       |
| 4693 373     | Co        | 0 N                     | 4701 714    | Ni        | 1                       |
| 4693 513     |           | 000 N                   | 4701 894    |           | 000                     |
| 4693 852     | Ti        | 0                       | 4702 083    |           | 0 N                     |
| 4693 964     |           | 000                     | 4702 310    |           | 00                      |
| 4694 125     | Ni, Ci    | 1                       | 4702 473    |           | 0                       |
| 4694 298     |           | 0 N                     | 4702 779    |           | 0                       |
| 4694 478     |           | 000                     | 4703 177 s  | Mg        | 10                      |
| 4694 632     |           | 00 N                    | 4703 666    |           | 0000 N                  |
| 4694 830     |           | 00 N d?                 | 4703 768    |           | 00                      |
| 4695 042     | Fe?       | 1                       | 4703 994 s  | Ni        | 3                       |
| 4695 078     |           | 00                      | 4704 195    |           | 000                     |
| 4695 331     | Ci        | 0                       | 4704 365    |           | 00 N d?                 |
| 4695 625     |           | 0 N                     | 4704 587    |           | 00                      |
| 4695 782     |           | 00                      | 4704 658    |           | 0                       |
| 4695 926     |           | 00                      | 4704 850    |           | 0000                    |
| 4696 032     |           | 00                      | 4704 962    |           | 0000                    |
| 4696 203     |           | 00                      | 4705 131    | Fe        | 4                       |
| 4696 444     |           | 00 N                    | 4705 325    |           | 0000                    |
| 4696 515     |           | 00                      | 4705 425    | ' Fe?     | 000                     |
| 4696 687     |           | 00                      | 4705 641    |           | 0                       |

| Wave length  | Substance      | Intensity and Character | Wave length  | Substance      | Intensity and Character |
|--------------|----------------|-------------------------|--------------|----------------|-------------------------|
| 4706 099     |                | 00                      | 4717 494     |                | 00                      |
| 4706 278     |                | 00                      | 4717 756     |                | 0                       |
| 4706 484     |                | 00                      | 4717 891     |                | 000                     |
| 4706 730     | V <sub>1</sub> | 0                       | 4718 065     |                | 00                      |
| 4707 249     |                | 000                     | 4718 601     | Cl             | 3                       |
| 4707 457     | -Fe            | 5 d?                    | 4718 766     |                | 000                     |
| 4707 672     |                | 2                       | 4719 012     |                | 000                     |
| 4707 937     |                | 00                      | 4719 407     |                | 00                      |
| 4708 196     | Cr             | 2                       | 4719 690     |                | 0                       |
| 4708 463     |                | 000 N                   | 4719 862     |                | 000                     |
| 4708 636     |                | 000 N d?                | 4720 035     |                | 000                     |
| 4708 846     |                | 2                       | 4720 318     |                | 00                      |
| 4709 153     | Γ <sub>1</sub> | 1                       | 4720 571     |                | 0000                    |
| 4709 271     | Fe             | 3                       | 4720 757     |                | 000                     |
| 4709 507     |                | 000 N d?                | 4720 996     |                | 000                     |
| 4709 680     |                | 000 N                   | 4721 179     | Fe?            | 2                       |
| 4709 896     | Mn             | 2                       | 4721 310     |                | 000                     |
| 4710 043     |                | 0000 N                  | 4721 498     |                | 000                     |
| 4710 252     |                | 000 N                   | 4721 705     |                | 0000                    |
| 4710 368     | T <sub>1</sub> | 00                      | 4721 927     |                | 0000                    |
| 4710 471     | Fe             | 3                       | 4722 155     |                | 000                     |
| 4710 737     |                | 000 N                   | 4722 342 s   | /n             | 3                       |
| 4711 197     |                | 000 N                   | 4722 464     |                | 000                     |
| 4711 665     | Fe?            | 0                       | 4722 646     |                | 0000                    |
| 4711 804     |                | 000                     | 4722 797     | I <sub>1</sub> | 0                       |
| 4712 260     | N <sub>1</sub> | 0                       | 4722 940     |                | 00                      |
| 4712 433     |                | 00                      | 4723 061     |                | 0000                    |
| 4712 677     |                | 00                      | 4723 179     |                | 000                     |
| 4712 883     |                | 00                      | 4723 294     | Cl             | 00                      |
| 4713 151     |                | 0000 N                  | 4723 359     | T <sub>1</sub> | 00                      |
| 4713 361     |                | 00                      | 4723 527     |                | 000                     |
| 4713 697     |                | 0000 N                  | 4723 628     |                | 0000                    |
| 4713 989     |                | 00                      | 4723 932     |                | 000                     |
| 4714 248     |                | 0                       | 4724 078     |                | 000                     |
| 4714 381     |                | 00                      | 4724 592     |                | 0                       |
| 4714 548 } s |                | 1                       | 4724 718     |                | 000                     |
| 4714 599 }   | N <sub>1</sub> | 6                       | 4725 033     |                | 000 N                   |
| 4714 730     |                | 0000                    | 4725 278     |                | 0000                    |
| 4714 909     |                | 0000                    | 4725 647     |                | 00                      |
| 4715 089     |                | 000                     | 4725 764     |                | 000                     |
| 4715 280     |                | 0000                    | 4726 133     |                | 00                      |
| 4715 474     | C?             | 00                      | 4726 327     | Fe?            | 0                       |
| 4715 631     |                | 0000                    | 4726 517     |                | 000                     |
| 4715 783     |                | 000                     | 4727 181     |                | 000                     |
| 4715 946     | N <sub>1</sub> | 4                       | 4727 337     | Cr             | 0                       |
| 4716 076     |                | 000                     | 4727 452     |                | 00                      |
| 4716 319     |                | 0000 N                  | 4727 582     | Fe             | 3                       |
| 4716 686     |                | 000                     | 4727 676 } s | Mn             | 2                       |
| 4717 015     |                | 00                      | 4728 032     |                | 00                      |
| 4717 306     |                | 0000                    | 4728 132     |                | 00                      |



| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 4728 349    |           | 0                       | 4739 140    |           | 0000                    |
| 4728 595    |           | 0000                    | 4739 291    | Mn        | 3                       |
| 4728 732    | Fe        | 4                       | 4739 473    |           | 0000                    |
| 4728 966    |           | 0000                    | 4739 635    |           | 00                      |
| 4729 207    | Fe?       | 1                       | 4739 839    |           | 0000 N                  |
| 4729 381    |           | 0000                    | 4740 099    |           | 0000 N                  |
| 4729 460    |           | 00                      | 4740 349    | Ni        | 00                      |
| 4729 864    | Fe? Cr    | 1                       | 4740 530    | Fe?       | 1                       |
| 4730 042    |           | 0000                    | 4740 668    |           | 0                       |
| 4730 212    |           | 2                       | 4741 131    |           | 1                       |
| 4730 583    |           | 000                     | 4741 260    | Fe?       | 1                       |
| 4730 897    | Cr        | 1                       | 4741 538    |           | 0000                    |
| 4731 177    |           | 0                       | 4741 718    | Fe        | 3                       |
| 4731 356    | Li        | 000                     | 4741 979    |           | 0000                    |
| 4731 466    |           | 0000                    | 4742 125    |           | 0000                    |
| 4731 651    | Fe?       | 4                       | 4742 307    |           | 000                     |
| 4731 841    |           | 0000                    | 4742 482    |           | 00                      |
| 4731 984    | Ni        | 1                       | 4742 730    |           | 00                      |
| 4732 228    |           | 000                     | 4742 979    | Ti        | 1                       |
| 4732 353    |           | 000                     | 4743 121    |           | 000                     |
| 4732 501    |           | 000                     | 4743 289    |           | 000                     |
| 4732 640    | Ni        | 1                       | 4743 481    |           | 0000                    |
| 4732 995    |           | 000                     | 4743 674    |           | 0000                    |
| 4733 126    |           | 0000                    | 4744 008    |           | 000                     |
| 4733 400    |           | 000                     | 4744 301    |           | 0000 N                  |
| 4733 604    | Ti        | 00                      | 4744 573    | Fe?       | 3                       |
| 4733 779    | Fe        | 4                       | 4744 826    |           | 000                     |
| 4733 936    |           | 0000                    | 4745 020    |           | 0000                    |
| 4734 169    |           | 000                     | 4745 131    |           | 000                     |
| 4734 283    | Fe?       | 1                       | 4745 325    |           | 00                      |
| 4734 361    |           | 0000                    | 4745 500    | Ca        | 00                      |
| 4734 612    |           | 000                     | 4745 890    |           | 0000                    |
| 4734 763    |           | 00                      | 4745 992    | Fe        | 4                       |
| 4734 847    |           | 0000                    | 4746 144    |           | 0000                    |
| 4735 019    |           | 000                     | 4746 305    |           | 000                     |
| 4735 181    |           | 0000                    | 4746 457    |           | 00                      |
| 4735 492    |           | 000                     | 4747 469    |           | 0000                    |
| 4735 625    |           | 000                     | 4747 868    |           | 000                     |
| 4735 843    |           | 000                     | 4748 015    |           | 0000                    |
| 4736 031    | Fe        | 3                       | 4748 167    | Na?       | 000                     |
| 4736 210    |           | 000                     | 4748 325    | Fe?       | 4                       |
| 4736 411    |           | 0000                    | 4748 552    |           | 0000                    |
| 4736 677    |           | 000                     | 4748 734    |           | 0000                    |
| 4736 963    | Fe        | 6                       | 4748 922    |           | 000                     |
| 4737 145    |           | 000                     | 4749 443    |           | 0000 N                  |
| 4737 297    |           | 0000 N                  | 4749 849    | Co        | 0 Nd                    |
| 4737 540    | Cr        | 2                       | 4750 139    | Fe?       | 1                       |
| 4737 817    | Fe?       | 1                       | 4751 279    |           | 0                       |
| 4737 945    |           | 0000                    | 4751 548    |           | 0000                    |
| 4738 522    |           | 0000 N d?               | 4751 738    |           | 000                     |

| Wave-length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 4752 012    | Na?       | 00                      | 4765 652    |           | 2                       |
| 4752 125    |           | 0000                    | 4765 851    |           | 0000                    |
| 4752 289    | Ni        | 2                       | 4766 050    | Mn        | 3                       |
| 4752 471    |           | 0000                    | 4766 621    | Mn        | 4                       |
| 4752 613    | Ni        | 3                       | 4766 827    | Cr        | 000                     |
| 4753 087    |           | 000                     | 4766 966    |           | 00                      |
| 4753 560    |           | 0000                    | 4767 066    |           | 000                     |
| 4754 225 s  | Mn        | 7                       | 4767 339    | Fe?       | 0000                    |
| 4754 549    | Co        | 00                      | 4767 471    |           | 0000                    |
| 4754 949    | Ni        | 1                       | 4768 049    | Cr        | 00                      |
| 4755 342    |           | 00                      | 4768 276    | Co        | 000                     |
| 4755 463    |           | 000                     | 4768 519    |           | 3                       |
| 4755 714    |           | 0000                    | 4768 595    | Fe        | 2                       |
| 4755 889    |           | 00                      | 4768 891    |           | 0                       |
| 4756 019    |           | 000                     | 4769 030    |           | 0000                    |
| 4756 300    | Cr        | 2                       | 4769 222    |           | 0000                    |
| 4756 552    |           | 000                     | 4769 991    | Ti        | 00 N                    |
| 4756 705    | Ni        | 3                       | 4770 188    |           | 000                     |
| 4756 913    |           | 0000                    | 4770 881    |           | 000 Nd?                 |
| 4757 213    |           | 0000                    | 4771 279    | Ti-Co     | 00                      |
| 4757 509    |           | 000                     | 4771 478    |           | 0000                    |
| 4757 771    | Fe        | 2                       | 4771 664    |           | 3                       |
| 4758 042    |           | 000 Nd?                 | 4771 903    | Fe        | 2                       |
| 4758 308    | Ti        | 1                       | 4772 086    |           | 0000                    |
| 4758 615    |           | 000                     | 4772 359    |           | 0000                    |
| 4758 918    |           | 00                      | 4772 511    |           | 000                     |
| 4759 107    |           | 00 N                    | 4772 814    |           | 0000                    |
| 4759 463    | Ti        | 2                       | 4773 007    | Fe        | 4                       |
| 4759 716    |           | 0000                    | 4773 209    |           | 0000                    |
| 4759 858    |           | 0000                    | 4773 333    |           | 000                     |
| 4759 959    |           | 0000                    | 4773 471    |           | 0000                    |
| 4760 113    |           | 000                     | 4773 605    |           | 00                      |
| 4760 261    |           | 00                      | 4773 715    |           | 0000                    |
| 4760 405    |           | 0000                    | 4773 900    |           | 0000                    |
| 4760 935    |           | 000                     | 4774 153    |           | 000                     |
| 4761 294    |           | 00 N                    | 4774 728    |           | 0000                    |
| 4761 439    |           | 000 N                   | 4775 330    |           | 000                     |
| 4761 718    | Mn        | 3                       | 4775 690    |           | 0000 N                  |
| 4761 899    |           | 0000                    | 4776 072    |           | 000                     |
| 4762 567    | Mn        | 5                       | 4776 259    | Fe        | 00                      |
| 4762 820    | Ni        | 1                       | 4776 546    | Co        | 0 d?                    |
| 4762 969    |           | 0                       | 4776 678    |           | 000                     |
| 4764 108    | Ti-Ni     | 4 d                     | 4777 370    |           | 0000                    |
| 4764 282    |           | 0000                    | 4777 780    |           | 000                     |
| 4764 479    | Cr        | 00                      | 4777 916    |           | 000                     |
| 4764 720    |           | 0                       | 4778 441    | Ti        | 00                      |
| 4764 839    |           | 0000                    | 4778 767    |           | 0000                    |
| 4764 945    |           | 000                     | 4779 634    | Fe        | 1                       |
| 4765 183    |           | 000                     | 4780 169    | Co        | 2                       |
| 4765 314    |           | 0000                    | 4780 640    |           | 0000                    |

| Wave length | Substance | Intensity and Character | Wave length  | Substance | Intensity and Character |
|-------------|-----------|-------------------------|--------------|-----------|-------------------------|
| 4781 007    |           | 000                     | 4796 852     |           | 0000 N                  |
| 4781 201    |           | 0000                    | 4797 090     | V         | 000                     |
| 4781 639    |           | 000 N d?                | 4797 230     |           | 000                     |
| 4781 913    |           | 00                      | 4797 352     |           | 000                     |
| 4782 256    |           | 000                     | 4797 544     |           | 0000                    |
| 4782 467    |           | 0000                    | 4797 813     |           | 0000                    |
| 4782 998    |           | 000                     | 4797 908     |           | 0000                    |
| 4783 169    |           | 00                      | 4798 169     |           | 0000                    |
| 4783 613 s  | Mn        | 6                       | 4798 293     | Ti        | 000                     |
| 4784 048    |           | 000                     | 4798 453     | Fe        | 1                       |
| 4784 189    |           | 0                       | 4798 724     |           | 1                       |
| 4784 898    |           | 0000                    | 4798 921     |           | 0                       |
| 4785 256    |           | 0000                    | 4799 255     |           | 0000                    |
| 4785 872    |           | 000                     | 4799 437     |           | 0000                    |
| 4786 145    | Fe?       | 0                       | 4799 598     | Fe        | 1                       |
| 4786 309    |           | 0000                    | 4799 771     |           | 0000                    |
| 4786 472    | Ni        | 0                       | 4799 984     | Ti        | 1                       |
| 4786 727    | Ni        | 3                       | 4800 080     | Cd        | 00                      |
| 4787 003    | Fe        | 2                       | 4800 322     |           | 000                     |
| 4787 289    |           | 0000                    | 4800 505     |           | 0000                    |
| 4787 694    |           | 0000                    | 4800 728     |           | 0000                    |
| 4788 018    | Fe?       | 1                       | 4800 842     | Ni-Fe     | 2                       |
| 4788 403    |           | 0000                    | 4801 027     |           | 0000                    |
| 4788 952    | Fe        | 3                       | 4801 213     | Cr        | 1                       |
| 4789 122    |           | 0000                    | 4801 421     |           | 0000Nd?                 |
| 4789 324    |           | 000                     | 4801 806     |           | 000                     |
| 4789 528    | Cr        | 2                       | 4802 100     |           | 0000                    |
| 4789 638    |           | 0000                    | 4802 709     |           | 00                      |
| 4789 849    | Fe        | 3                       | 4802 879     |           | 0000                    |
| 4790 522    | Cr        | 00                      | 4803 072     | Fe        | 2                       |
| 4790 755    |           | 000                     | 4803 233     |           | 0000                    |
| 4790 937    |           | 000                     | 4803 871     |           | 0000                    |
| 4791 157    |           | 00                      | 4804 232     |           | 000                     |
| 4791 329    |           | 0                       | 4804 706     | Co?       | 0                       |
| 4791 439    | Fe?       | 1                       | 4804 833     |           | 000                     |
| 4791 787    |           | 0000                    | 4805 035     |           | 0000                    |
| 4792 393    |           | 0000                    | 4805 191 } s |           | 0                       |
| 4792 500    |           | 00                      | 4805 285 }   |           | 3                       |
| 4792 702    | Ti Cr     | 2                       | 4805 476     |           | 0000                    |
| 4793 045    | Co        | 1                       | 4805 606     | Ti        | 0                       |
| 4793 635    |           | 0000                    | 4806 437     |           | 000                     |
| 4793 927    |           | 0000                    | 4806 523     |           | 000                     |
| 4794 165    |           | 000                     | 4806 801     |           | 0000                    |
| 4794 549    |           | 00                      | 4806 984     |           | 0000                    |
| 4794 850    |           | 0000                    | 4807 179     | Ni        | 2                       |
| 4795 024    |           | 0000                    | 4807 411     |           | 000                     |
| 4796 041    |           | 000                     | 4807 725     | Cr        | 000                     |
| 4796 228    |           | 0000                    | 4807 900     | Fe        | 1                       |
| 4796 373    | Cr-Ti     | 00                      | 4808 340     |           | 0                       |
| 4796 551    |           | 0000                    | 4808 733     | Ti        | 00                      |

| Wave length  | Substance      | Intensity and Character | Wave length | Substance           | Intensity and Character |
|--------------|----------------|-------------------------|-------------|---------------------|-------------------------|
| 4854 060     |                | 0000                    | 4866 465    | N <sub>1</sub>      | 2                       |
| 4854 346     |                | 000                     | 4866 930    |                     | 0000                    |
| 4854 535     |                | 0000                    | 4867 071    |                     | 0000                    |
| 4854 809     |                | 000                     | 4867 724    |                     | 00                      |
| 4855 059     | Fe             | I                       | 4867 822    |                     | 0000                    |
| 4855 348     |                | 000                     | 4868 056    | Co                  | I                       |
| 4855 416     |                | 0000                    | 4868 296    |                     | 0000                    |
| 4855 600     | N <sub>1</sub> | 3                       | 4868 451    | T <sub>1</sub>      | 0                       |
| 4855 740     |                | 0000                    | 4868 599    |                     | 00 d ?                  |
| 4855 859     | Fe             | 2                       | 4868 991    |                     | 0000                    |
| 4856 084     |                | 0000                    | 4869 119    |                     | 0000                    |
| 4856 203     | T <sub>1</sub> | I                       | 4869 330    |                     | 0000                    |
| 4856 380     |                | 00                      | 4869 652    | Fe?                 | 0                       |
| 4856 580     |                | 0000                    | 4870 230    |                     | 00                      |
| 4857 082     |                | 000                     | 4870 323    | T <sub>1</sub>      | I                       |
| 4857 280     |                | 000                     | 4870 603    |                     | 000 N                   |
| 4857 579     | N <sub>1</sub> | I                       | 4870 829    |                     | 0000 N                  |
| 4857 744     |                | 0000                    | 4870 996    | N <sub>1</sub> , Cr | 3                       |
| 4857 967     |                | 000 N                   | 4871 232    |                     | 000                     |
| 4858 323     |                | 0000                    | 4871 404    |                     | 0000                    |
| 4858 443     |                | 000                     | 4871 512    | Fe                  | 5                       |
| 4858 508     |                | 0000                    | 4871 867    |                     | 0000 N                  |
| 4858 675     |                | 0000                    | 4872 112    |                     | I                       |
| 4858 968     |                | 0000                    | 4872 332    | Fe                  | 4                       |
| 4859 221     |                | 000                     | 4872 692    |                     | 0000 N                  |
| 4859 316     | Fe?            | 0                       | 4872 885    |                     | 0000                    |
| 4859 485     |                | 0000                    | 4873 092    |                     | 000                     |
| 4859 667     |                | 0000                    | 4873 276    |                     | 0000                    |
| 4859 928 s   | Fe             | 4                       | 4873 440    |                     | 0                       |
| 4860 203     |                | 0000                    | 4873 630    | N <sub>1</sub>      | 2                       |
| 4860 401     |                | 00                      | 4873 792    |                     | 0000                    |
| 4861 173     |                | 0                       | 4873 935    |                     | 00                      |
| 4861 527 s F | H              | * 30                    | 4874 055    |                     | 0000                    |
| 4862 029     | Cr             | 0                       | 4874 196    |                     | 0                       |
| 4862 134     |                | 00                      | 4874 379    |                     | 0000                    |
| 4862 368     |                | 000                     | 4874 544    |                     | 0                       |
| 4862 550     |                | 0000                    | 4874 693    |                     | 0000                    |
| 4862 732     |                | 000                     | 4874 834    |                     | 000                     |
| 4862 783     |                | 0                       | 4874 976    | N <sub>1</sub>      | 0                       |
| 4863 277     |                | 000                     | 4875 277    |                     | 0000                    |
| 4863 431     |                | 0000                    | 4875 215    |                     | 0                       |
| 4863 649     |                | 000                     | 4875 381    |                     | 0000                    |
| 4863 833     | Fe             | 2                       | 4875 522    |                     | 0000                    |
| 4863 961     |                | 0000                    | 4875 671    | V                   | I                       |
| 4864 160     |                | 0                       | 4875 921    |                     | 0000                    |
| 4864 362     |                | 0000                    | 4876 060    | Fe                  | 2                       |
| 4864 505     |                | I                       | 4876 275    |                     | 0000                    |
| 4864 726     |                | 0000                    | 4876 384    |                     | 000                     |
| 4864 919     | V              | 0                       | 4876 586    |                     | I                       |
| 4865 798     |                | I                       | 4876 666    |                     | 00                      |

\* Width of F is 0.750.

| Wave length | Substance | Intensity and Character | Wave length  | Substance | Intensity and Character |
|-------------|-----------|-------------------------|--------------|-----------|-------------------------|
| 4876 855    |           | 000                     | 4888 822     | Fe        | 2                       |
| 4877 772    |           | 0                       | 4889 011     |           | 0000                    |
| 4878 033    |           | 000 N                   | 4889 187     | Fe?       | 3                       |
| 4878 313    | Ca        | 3                       | 4889 294     | Fe        | 2                       |
| 4878 407    | Fe        | 4                       | 4889 830     |           | 0000                    |
| 4878 690    |           | 0000                    | 4890 397     |           | 0000                    |
| 4878 902    |           | 000                     | 4890 620     |           | 0000                    |
| 4879 331    |           | 000                     | 4890 948 s   | Fe        | 6                       |
| 4879 701    |           | 0000                    | 4891 223     |           | 000                     |
| 4879 883    |           | 0000                    | 4891 332     | Co        | 000                     |
| 4880 225    |           | 000                     | 4891 683     | Fe        | 8                       |
| 4880 501    |           | 0000                    | 4892 047     |           | 000                     |
| 4880 715    |           | 000                     | 4892 138     |           | 0000                    |
| 4881 128    | Ti        | 000                     | 4893 030     | Fe        | 1                       |
| 4881 448    |           | 0000                    | 4893 228     |           | 000                     |
| 4881 739    | V         | 1 N                     | 4893 434     |           | 0000                    |
| 4881 904    | Fe        | 2                       | 4893 606     |           | 000                     |
| 4882 129    |           | 0000                    | 4893 751     |           | 0000                    |
| 4882 336    | Fe        | 3                       | 4893 886     |           | 000                     |
| 4882 518    | Ti        | 000                     | 4893 997     |           | 00                      |
| 4882 670    |           | 000                     | 4894 141     |           | 0000                    |
| 4882 891    |           | 000                     | 4894 551     |           | 000 N                   |
| 4883 091    |           | 0000 N                  | 4894 743     |           | 00                      |
| 4883 313    |           | 0000 N                  | 4894 977     |           | 0000                    |
| 4883 651    |           | 000 N                   | 4895 214     |           | 0000                    |
| 4883 867    | Yt earth  | 2                       | 4895 841     |           | 000 N                   |
| 4884 084    |           | 000                     | 4896 625     | Fe        | 1                       |
| 4884 242    | Mn        | 000                     | 4896 763     |           | 000                     |
| 4884 779    |           | 0                       | 4897 379     |           | 0000                    |
| 4884 984    |           | 000                     | 4897 652     |           | 000                     |
| 4885 124    |           | 000                     | 4898 652     |           | 0000                    |
| 4885 264    | Ti        | 2                       | 4898 798     |           | 0000                    |
| 4885 418    |           | 0000                    | 4899 702     |           | 000 Nd?                 |
| 4885 620    | Fe        | 3                       | 4899 917     |           | 0000                    |
| 4885 802    |           | 0000                    | 4900 095 s   | Ti La     | 2                       |
| 4885 955    | Cr        | 0                       | 4900 301 s   | Y?        | 2                       |
| 4886 132    | Cr        | 00                      | 4900 455     |           | 0000                    |
| 4886 268    |           | 0000                    | 4900 648     |           | 0000                    |
| 4886 359    |           | 0000                    | 4900 808     |           | 000                     |
| 4886 522    | Fe        | 3                       | 4901 002     |           | 00                      |
| 4886 757    |           | 0000                    | 4901 152     | Ti        | 0                       |
| 4886 899    |           | 000                     | 4901 498     |           | 0000 N                  |
| 4887 027    |           | 0000                    | 4901 793     |           | 000 N                   |
| 4887 187    | Ni, Cr    | 2                       | 4902 028     |           | 000 N                   |
| 4887 381    | Fe?       | 2                       | 4902 257     |           | 0000                    |
| 4887 549    |           | 00                      | 4902 416     |           | 000                     |
| 4887 715    |           | 0000                    | 4902 562     |           | 000                     |
| 4887 879    |           | 000                     | 4903 278     |           | 0000                    |
| 4888 344    |           | 000                     | 4903 440 } s | Cr        | 0                       |
| 4888 706    | Cr        | 00                      | 4903 502 }   | Fe        | 5                       |

| Wave length | Substance | Intensity and Character | Wave length  | Substance | Intensity and Character |
|-------------|-----------|-------------------------|--------------|-----------|-------------------------|
| 4954 472    |           | 0000                    | 4971 531     | Ni-       | I                       |
| 4954 782    | Fe        | I                       | 4972 096     |           | 0000 N                  |
| 4954 986    | Cr        | 2                       | 4972 357     |           | 0000                    |
| 4956 152    |           | 000                     | 4972 572     |           | 0000                    |
| 4956 922    |           | 0000                    | 4972 832     |           | 0000 N                  |
| 4957 480 s  | Fe        | 5                       | 4973 088     |           | 0000                    |
| 4957 650    |           | 0000                    | 4973 281 s   | Ti Fe     | 4                       |
| 4957 785 s  | Fe        | 8                       | 4973 533     |           | 0000                    |
| 4957 878    |           | 000                     | 4973 827     |           | 0000                    |
| 4958 207    |           | 0000                    | 4974 431     |           | 000                     |
| 4958 431    | Ti        | 00                      | 4974 537     |           | 0000                    |
| 4959 320    |           | 0000                    | 4974 642     |           | 0000                    |
| 4959 381    |           | 00                      | 4974 728     |           | 0000                    |
| 4960 526    |           | 0000                    | 4975 530     | Ti        | 00                      |
| 4961 039    |           | 0000                    | 4975 588     | Fe        | 00                      |
| 4961 235    |           | 00                      | 4975 729     |           | 0000                    |
| 4961 564    |           | 0000                    | 4976 314     | Ni        | 0                       |
| 4962 095    |           | 0                       | 4976 508     | Ni        | I                       |
| 4962 298    |           | 0000                    | 4976 671     |           | 0000                    |
| 4962 467    | Sr?       | 000                     | 4976 868     |           | 000                     |
| 4962 751    | Fe        | 2                       | 4977 056     |           | 0000                    |
| 4962 905    |           | 0000                    | 4977 833     | Fe        | 0                       |
| 4963 087    |           | 0000                    | 4977 891     |           | 0000                    |
| 4963 245    |           | 0000                    | 4978 104     |           | 0000 N                  |
| 4963 725    |           | 0000                    | 4978 289     |           | 000                     |
| 4964 312    |           | 000                     | 4978 372     | Ti        | 00                      |
| 4964 903    | Ti        | 000                     | 4978 544     |           | 0000                    |
| 4965 107    | Cr        | I                       | 4978 732 } s | Fe        | 0                       |
| 4965 351    | Ni        | 0                       | 4978 785 }   |           | 3                       |
| 4965 580    |           | 0000                    | 4978 863     |           | 0000                    |
| 4965 986    |           | 0000                    | 4979 112     |           | 0000                    |
| 4966 036    | Mn        | 00                      | 4979 232     |           | 0000                    |
| 4966 270    | Fe        | 4                       | 4979 391     |           | 000                     |
| 4966 460    |           | 000                     | 4979 485     |           | 0000                    |
| 4966 761    |           | 0000                    | 4979 767     | Fe        | 00                      |
| 4966 979    |           | 0000                    | 4979 885     |           | 0000                    |
| 4967 449    |           | 0000                    | 4980 012     |           | 0000                    |
| 4967 571    |           | 0000                    | 4980 143     |           | 0000                    |
| 4967 700    | Ni        | 00                      | 4980 352 s   | Ni-       | 4                       |
| 4967 859    |           | 0000                    | 4980 477     |           | 000                     |
| 4968 080    | Fe        | 3                       | 4980 723     |           | 000                     |
| 4968 569    |           | 00                      | 4981 453     |           | 0000                    |
| 4968 769    | Ti        | 0                       | 4981 550     |           | 000                     |
| 4968 880    | Fe        | I                       | 4981 912 s   | Ti        | 4                       |
| 4969 028    |           | 0000                    | 4982 319     |           | 000                     |
| 4970 098    | Fe        | 3                       | 4982 682     | Fe        | 4                       |
| 4970 291    |           | 0000                    | 4982 994     |           | 2                       |
| 4970 382    |           | 0000                    | 4983 205     |           | 0000                    |
| 4970 671    | Fe        | I                       | 4983 433     | Fe        | 3                       |
| 4970 829    |           | 0                       | 4983 644     |           | 0000                    |

| Wave length | Substance | Intensity and Character | Wave length  | Substance | Intensity and Character |
|-------------|-----------|-------------------------|--------------|-----------|-------------------------|
| 4983 777    |           | 0000                    | 4998 742     |           | 0000                    |
| 4984 028    | Fe        | 3                       | 4999 141     |           | 0000                    |
| 4984 297    | Ni        | 2                       | 4999 297     | Fe        | 0                       |
| 4984 476    |           | 0000                    | 4999 439     |           | 0000                    |
| 4984 632    |           | 0000                    | 4999 689 s   | Ti, La    | 3                       |
| 4984 806    |           | 00                      | 5000 388     |           | 000                     |
| 4985 432    | Fe        | 3                       | 5000 526     | Ni-       | 2                       |
| 4985 730    | Fe        | 3                       | 5000 721     |           | 0000                    |
| 4985 941    |           | 0000                    | 5000 917     |           | 000                     |
| 4986 165    | Cr        | 00                      | 5001 165     | Ti        | 0                       |
| 4986 403    | Fe        | 1                       | 5001 387     |           | 0000                    |
| 4987 088    |           | 00                      | 5001 654     |           | 000                     |
| 4987 260    |           | 0000                    | 5002 044     | Fe        | 5                       |
| 4987 452    |           | 0000                    | 5002 510     |           | 0000                    |
| 4987 610    |           | 0000                    | 5002 771     |           | 0000                    |
| 4987 827    |           | 0000                    | 5002 976     | Fe        | 2                       |
| 4988 030    |           | 0000                    | 5003 924     | Ni        | 0                       |
| 4988 313    |           | 000                     | 5004 056     |           | 0000                    |
| 4988 535    |           | 0000                    | 5004 226     | Fe        | 0                       |
| 4989 130    | Fe        | 2                       | 5004 393     |           | 0000                    |
| 4989 325    | Ti        | 00                      | 5004 547     | Cr        | 000 d                   |
| 4989 730    |           | 0000                    | 5005 068     |           | 00                      |
| 4990 147    |           | 000                     | 5005 347     | Mn        | 0                       |
| 4990 625    | Fe        | 0                       | 5005 581     |           | 000                     |
| 4991 247    | Ti        | 3                       | 5005 675     | Pb?       | 0000                    |
| 4991 452    | Fe, La    | 2                       | 5005 896 s   | Fe        | 4                       |
| 4992 036    |           | 00                      | 5006 306 s   | Fe        | 5                       |
| 4992 252    |           | 0000 N                  | 5006 556     |           | 000                     |
| 4992 461    |           | 000                     | 5006 709     |           | 000                     |
| 4992 657    |           | 0000                    | 5006 870     |           | 000                     |
| 4992 962    |           | 000                     | 5007 398 } s | Ti        | 3                       |
| 4993 173    |           | 0000                    | 5007 461 }   | Fe        | 2                       |
| 4993 531    |           | 0                       | 5007 912     |           | 00                      |
| 4993 699    |           | 0000                    | 5008 217     |           | 0000                    |
| 4993 864    | Fe        | 0                       | 5008 409     |           | 0000                    |
| 4993 926    |           | 000                     | 5008 632     |           | 0000                    |
| 4994 114    |           | 0000                    | 5008 825     |           | 000                     |
| 4994 316 s  | Fe        | 3                       | 5009 370     |           | 0000                    |
| 4995 208    |           | 0000 N d?               | 5009 604     |           | 000                     |
| 4995 586    |           | 00                      | 5009 829     | Ti, Co    | 00                      |
| 4995 835    |           | 00                      | 5010 006     |           | 0000 d?                 |
| 4996 050    |           | 0000                    | 5010 199     | Ni        | 0                       |
| 4996 375    |           | 0000                    | 5010 396     |           | 00                      |
| 4996 558    |           | 000                     | 5010 506     |           | 000                     |
| 4996 812    |           | 0000                    | 5011 119     | Ni        | 0                       |
| 4997 024    | Ni        | 1                       | 5011 384     |           | 000                     |
| 4997 161    |           | 0000                    | 5012 252     | Fe        | 4                       |
| 4997 283    | Ti        | 0                       | 5012 335     |           | 1                       |
| 4998 139    |           | 000 N                   | 5012 490     |           | 0000                    |
| 4998 408    | Ni        | 1                       | 5012 625     | Ni        | 1                       |

| Wave length  | Substance | Intensity and Character | Wave length  | Substance | Intensity and Character |
|--------------|-----------|-------------------------|--------------|-----------|-------------------------|
| 5012 773     |           | 0000                    | 5024 403     |           | 000                     |
| 5012 875     |           | 0                       | 5025 027     | Ti        | 3                       |
| 5013 479     | Cr, Ti    | 2                       | 5025 256     | Ni        | 00                      |
| 5013 644     |           | 0000                    | 5025 482     |           | 00                      |
| 5013 871     | Ti        | 0                       | 5025 749     | Ti        | 1                       |
| 5013 953     |           | 0000                    | 5025 938     |           | 000                     |
| 5014 100     |           | 00                      | 5026 086     |           | 0000                    |
| 5014 236     |           | 000                     | 5026 670     |           | 0000                    |
| 5014 369 } s | Ti        | 2                       | 5027 305     | Fe        | 3                       |
| 5014 457 } s | Fe        | 3                       | 5027 406     |           | 00                      |
| 5015 123     | Fe        | 3                       | 5027 531     |           | 000                     |
| 5015 304     |           | 0000                    | 5027 707     |           | 0000                    |
| 5015 476     |           | 000                     | 5027 798     |           | 0000                    |
| 5016 220     |           | 000                     | 5027 939     | Fe        | 1                       |
| 5016 340     | Ti        | 2                       | 5028 101     |           | 0000                    |
| 5016 504     |           | 0000                    | 5028 308     | Fe        | 2                       |
| 5016 659     |           | 00                      | 5028 537     |           | 000                     |
| 5016 864     |           | 0000                    | 5028 719     |           | 0000                    |
| 5017 060     | Fe        | 0                       | 5029 660     |           | 0000                    |
| 5017 228     |           | 0000                    | 5029 805     | Fe        | 1                       |
| 5017 370     |           | 0000                    | 5029 994     |           | 000                     |
| 5017 562     |           | 0000                    | 5030 096     |           | 0000                    |
| 5017 762     | Ni        | 3                       | 5030 218     |           | 0000                    |
| 5017 997     |           | 000                     | 5030 817     |           | 000                     |
| 5018 210     |           | 0000 N                  | 5030 960     |           | 00                      |
| 5018 463     | Ni        | 1                       | 5031 058     |           | 0000                    |
| 5018 629     | Fe        | 4                       | 5031 199     |           | 3                       |
| 5019 059     |           | 0000 N                  | 5031 361     |           | 000                     |
| 5019 364     |           | 000                     | 5031 939     |           | 0000                    |
| 5019 664     |           | 0000                    | 5032 092     |           | 00                      |
| 5019 912     |           | 00                      | 5032 252     |           | 0000                    |
| 5020 208 } s | Ti        | 2                       | 5032 560     |           | 000 N                   |
| 5020 675     |           | 000                     | 5032 912     | Ni        | 00                      |
| 5020 873     |           | 0000                    | 5033 305     |           | 0000 N                  |
| 5020 998     |           | 00                      | 5033 714     |           | 000                     |
| 5021 177     |           | 000                     | 5033 835     |           | 000                     |
| 5021 328     |           | 0000                    | 5033 960     |           | 000                     |
| 5021 778     | Fe        | 0                       | 5034 354     |           | 000                     |
| 5021 869     |           | 000                     | 5034 530     |           | 0000                    |
| 5022 108     | Cr        | 000                     | 5035 542     | Ni        | 5                       |
| 5022 240     |           | 0000                    | 5035 846     |           | 000 Nd?                 |
| 5022 414     | Fe        | 3                       | 5036 089 } s | Ti        | 3                       |
| 5023 052     | Ti        | 2                       | 5036 155 } s | Ni        | 2                       |
| 5023 221     |           | 0000                    | 5036 332     |           | 0000                    |
| 5023 372     | Fe        | 0                       | 5036 449     | Fe        | 0                       |
| 5023 53      |           | 0000                    | 5036 645     | Ti        | 2                       |
| 5023 674     | Fe        | 0                       | 5036 909     |           | 0000 Nd?                |
| 5023 819     |           | 0000                    | 5037 105     | Fe        | 00                      |
| 5024 010     |           | 000                     | 5037 375     |           | 0000                    |
| 5024 190     |           | 0000                    | 5037 496     |           | 0000                    |



| Wave length | Substance              | Intensity<br>and<br>Character | Wave length | Substance          | Intensity<br>and<br>Character |
|-------------|------------------------|-------------------------------|-------------|--------------------|-------------------------------|
| 5037 669    |                        | 0000                          | 5049 769    |                    | { 0000                        |
| 5037 885    |                        | 000                           | 5049 860    |                    | { 0000                        |
| 5037 983    |                        | 000                           | 5050 008 s  | Fe                 | 6                             |
| 5038 579    | T <sub>1</sub>         | 2                             | 5050 316    |                    | 000                           |
| 5038 774    | Ni?                    | 2                             | 5050 626    |                    | 000                           |
| 5038 974    |                        | 0000                          | 5050 751    |                    | 0000                          |
| 5039 065    |                        | 000                           | 5050 919    |                    | 000                           |
| 5039 239    |                        | 000                           | 5051 145    |                    | 00                            |
| 5039 428    | Fe                     | 3                             | 5051 488    |                    | 000 N                         |
| 5039 542    | N <sub>1</sub>         | 00                            | 5051 683    | N <sub>1</sub>     | 1                             |
| 5039 683    |                        | 0000                          | 5051 825    | Fe                 | 4                             |
| 5039 951    |                        | 000                           | 5052 084    | C <sub>1</sub>     | 0                             |
| 5040 138    | T <sub>1</sub>         | 3                             | 5052 338    |                    | 0 N                           |
| 5040 300    |                        | 0000                          | 5052 803    |                    | 00                            |
| 5040 422    |                        | 000                           | 5052 917    |                    | 0000                          |
| 5040 644    |                        | 0000                          | 5053 056    | T <sub>1</sub>     | 0                             |
| 5040 787    | T <sub>1</sub>         | 00                            | 5053 170    |                    | 00                            |
| 5040 908    |                        | 0000                          | 5053 301    |                    | 0000                          |
| 5041 069    | Fe                     | 3 d?                          | 5053 477    |                    | 000                           |
| 5041 255    | Fe                     | 4                             | 5053 756    |                    | 00 N                          |
| 5041 499    | T <sub>1</sub>         | 00                            | 5054 261    |                    | 000                           |
| 5041 633    |                        | 00                            | 5054 821    | Fe                 | 1                             |
| 5041 795 s  | Ca                     | 2                             | 5055 762    |                    | 000                           |
| 5041 936    | Fe                     | 4                             | 5055 975    |                    | 0000                          |
| 5042 033    | N <sub>1</sub>         | 00                            | 5056 169    | Fe                 | 00                            |
| 5042 200    |                        | 0000                          | 5056 307    |                    | 000                           |
| 5042 367    | N <sub>1</sub>         | 1                             | 5056 428    |                    | 000                           |
| 5043 475    |                        | 000                           | 5056 617    |                    | 000                           |
| 5043 761    | T <sub>1</sub>         | 00                            | 5057 021    | Fe                 | 1                             |
| 5043 885    |                        | 0000                          | 5057 665    | Fe, N <sub>1</sub> | 0                             |
| 5044 011    |                        | 0000                          | 5057 875    |                    | 0000                          |
| 5044 212    |                        | 000                           | 5058 017    |                    | 000                           |
| 5044 394    | N <sub>1</sub> , Co Fe | 3                             | 5058 167    | Fe                 | 1                             |
| 5044 945    |                        | 0000 N                        | 5058 421    |                    | 000 N                         |
| 5045 454    |                        | 00                            | 5058 674    | Fe                 | 00                            |
| 5045 582    | T <sub>1</sub>         | 00                            | 5058 989    |                    | 0000                          |
| 5046 379    |                        | 000 N                         | 5059 110    |                    | 0000                          |
| 5047 107    |                        | 000                           | 5059 409    |                    | 000                           |
| 5047 301    |                        | 000                           | 5059 575    |                    | 0000                          |
| 5047 483    |                        | 000 d                         | 5059 964    | Co                 | 00                            |
| 5047 726    |                        | 0000                          | 5060 111    |                    | 0000                          |
| 5047 898    |                        | 0000                          | 5060 258 s  | Fe                 | 3                             |
| 5048 120    |                        | 00                            | 5060 476    |                    | 0000                          |
| 5048 242    | N <sub>1</sub>         | 0                             | 5061 575    |                    | 000                           |
| 5048 409    |                        | 00 N d                        | 5061 703    |                    | 000                           |
| 5048 612    | Fe                     | 3                             | 5061 882    |                    | 00                            |
| 5049 035    | N <sub>1</sub> -       | 2                             | 5062 066    |                    | 000 N                         |
| 5049 192    |                        | 0000                          | 5062 285    | T <sub>1</sub>     | 0                             |
| 5049 384    |                        | 0000                          | 5062 530    |                    | 0000                          |
| 5049 607    |                        | 0000                          | 5063 355    |                    | 00                            |

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 5063 479    |           | 000                     | 5074 932    | Fe        | 5                       |
| 5063 699    |           | 0000                    | 5075 154    |           | 0000                    |
| 5063 927    |           | 0000                    | 5075 341    |           | 0000                    |
| 5064 058    |           | 0000                    | 5075 480    | Ti        | 00                      |
| 5064 244    | Ti        | 00                      | 5075 716    |           | 0000                    |
| 5064 557    |           | 0000 N                  | 5075 989    |           | 0000                    |
| 5064 836 s  | Ti        | 3                       | 5076 277    |           | 000                     |
| 5064 989    |           | 0000                    | 5076 450    | Fe        | 3                       |
| 5065 152    |           | 1                       | 5076 504    |           | 000                     |
| 5065 207    | Fe        | 3                       | 5076 666    |           | 0000                    |
| 5065 380    | Fe        | 2                       | 5076 807    | Ti        | 00                      |
| 5065 556    |           | 0000                    | 5076 950    |           | 000                     |
| 5065 890    |           | 0000                    | 5077 562    |           | 000                     |
| 5066 078    | Cr        | 000                     | 5077 780    |           | 0000                    |
| 5066 174    | Ti        | 000                     | 5078 013    |           | 0000 d                  |
| 5066 446    |           | 0000                    | 5078 246    |           | 000                     |
| 5066 545    |           | 0000                    | 5078 541    |           | 000                     |
| 5066 908    |           | 00                      | 5078 719    |           | 0000                    |
| 5067 039    |           | 000                     | 5078 891    |           | 0000                    |
| 5067 336    | Fe        | 3                       | 5079 158    | Fe        | 3                       |
| 5067 679    |           | 000 N                   | 5079 409    | Fe        | 4                       |
| 5067 874    | Cr        | 0                       | 5079 732    |           | 0000                    |
| 5067 954    | Co        | 000                     | 5079 921    | Fe        | 4                       |
| 5068 485    | Cr, Ti    | 0000                    | 5080 144    | Ni        | 1                       |
| 5068 944 s  | Fe        | 5                       | 5080 288    |           | 0000                    |
| 5069 267    |           | 000                     | 5080 505    |           | 00                      |
| 5069 592    | Ti        | 000 d                   | 5080 714    | Ni        | 4                       |
| 5069 802    |           | 0000                    | 5080 966    |           | 0000                    |
| 5069 971    |           | 0000                    | 5081 111    |           | 0000                    |
| 5070 165    |           | 00                      | 5081 286    | Ni        | 3                       |
| 5070 313    |           | 000                     | 5081 534    |           | 0000 N                  |
| 5070 471    |           | 0000                    | 5081 764    |           | 000                     |
| 5070 615    |           | 0000                    | 5081 942    |           | 000                     |
| 5071 098    |           | 000                     | 5082 019    |           | 000                     |
| 5071 311    |           | 000                     | 5082 231    |           | 0000                    |
| 5071 435    |           | 0000                    | 5082 363    |           | 0000                    |
| 5071 666    | Ti        | 0                       | 5082 526    | Ni        | 2                       |
| 5071 969    |           | 000 N                   | 5082 829    |           | 0000                    |
| 5072 032    |           | 0000                    | 5083 071    |           | 0000                    |
| 5072 257    | Fe        | 3                       | 5083 205    |           | 000 Nd?                 |
| 5072 479    | Ti        | 0                       | 5083 365    |           | 0000                    |
| 5072 650    |           | 0000                    | 5083 518 s  | Fe        | 4                       |
| 5072 849    | Fe        | 2                       | 5083 709    |           | 0000                    |
| 5073 114    | Cr        | 1                       | 5083 877    |           | 000                     |
| 5073 348    |           | 0000                    | 5084 038    |           | 000                     |
| 5073 637    | Ti        | 00                      | 5084 279    | Ni        | 3                       |
| 5073 776    |           | 0000                    | 5084 590    |           | 0000                    |
| 5073 924    |           | 000                     | 5084 734    |           | 000                     |
| 5074 244    |           | 0000 N                  | 5084 876    |           | 000                     |
| 5074 521    |           | 000                     | 5085 017    |           | 000                     |

| Wave length | Substance | Intensity and Character | Wave length  | Substance | Intensity and Character |
|-------------|-----------|-------------------------|--------------|-----------|-------------------------|
| 5085 179    | Ti        | 0000                    | 5096 215     | Ni<br>Fe  | 0000                    |
| 5085 341    |           | 0000                    | 5096 357     |           | 000                     |
| 5085 513    |           | 000                     | 5096 660     |           | 0000                    |
| 5085 668    | Cd?       | 0                       | 5096 762     |           | 0000                    |
| 5085 856    |           | 000                     | 5096 908     |           | 000                     |
| 5086 078    |           | 0000 N                  | 5097 038     |           | 0                       |
| 5086 422    |           | 00                      | 5097 175 } s |           | 3                       |
| 5086 570    | Ti        | 000                     | 5097 489     |           | 000                     |
| 5086 794    |           | 0000                    | 5097 668     |           | 0                       |
| 5086 947    |           | 000                     | 5097 884     |           | 0000                    |
| 5087 104    |           | 0000                    | 5098 046     | Fe        | 0000                    |
| 5087 239    | Y?        | 0                       | 5098 302     |           | 00 N                    |
| 5087 432    |           | 0000                    | 5098 492     |           | 000 N                   |
| 5087 601    | Ni        | I                       | 5098 751     |           | I                       |
| 5088 019    |           | 0000 N                  | 5098 885     | Fe        | 3                       |
| 5088 175    |           | 000                     | 5099 104     |           | 0000 N                  |
| 5088 331    | Ni        | 0                       | 5099 251     | Fe        | 0                       |
| 5088 719    |           | 0                       | 5099 497     |           | I                       |
| 5088 929    |           | 0000                    | 5099 744     | Ni        | 0000 N                  |
| 5089 134    | Fe        | 0                       | 5099 957     |           | 000                     |
| 5089 387    |           | 000 N d?                | 5100 108     |           | 2                       |
| 5089 541    |           | 0000                    | 5100 413     |           | 0000                    |
| 5090 004    | Cr        | 0000                    | 5100 636     | Ni        | 0000                    |
| 5090 236    |           | 0000 N                  | 5100 827     |           | 00                      |
| 5090 391    |           | 000                     | 5101 028     |           | 000                     |
| 5090 569    |           | 0000                    | 5101 108     |           | 000                     |
| 5090 954 s  | Fe        | 5                       | 5101 251     |           | 000                     |
| 5091 146    |           | 0000                    | 5101 445     |           | 0000                    |
| 5091 353    |           | 0000                    | 5101 655     |           | 000                     |
| 5091 477    |           | 0000                    | 5101 790     |           | 000Q                    |
| 5091 662    | Ni        | 0000                    | 5101 994     |           | 0000                    |
| 5091 896    |           | 000                     | 5102 184     |           | 0000                    |
| 5092 058    |           | 00                      | 5102 410     |           | 0000                    |
| 5092 285    |           | 0000                    | 5102 599     |           | 000                     |
| 5092 483    | Ni        | 00                      | 5102 843     |           | 0000                    |
| 5092 665    |           | 0000                    | 5103 142     | Fe        | I                       |
| 5092 977    |           | 000                     | 5103 297     |           | 0000                    |
| 5093 220    |           | 0000                    | 5103 567     |           | 000                     |
| 5093 513    | Ni        | 0000                    | 5103 721     |           | 0000                    |
| 5093 623    |           | 0000                    | 5103 909     | Fe        | 000                     |
| 5093 858    |           | 0000 N                  | 5104 083     |           | 0000                    |
| 5094 199    |           | 000 N                   | 5104 204     |           | 0                       |
| 5094 594    | Ni        | 0                       | 5104 366     |           | 0                       |
| 5094 789    |           | 0000                    | 5104 614     | Fe        | 0                       |
| 5095 117    |           | 00                      | 5104 817     |           | 0000                    |
| 5095 348    |           | 00 d?                   | 5105 066     |           | 000                     |
| 5095 512    | Ni        | 00                      | 5105 260     |           | 0000                    |
| 5095 679    |           | 0000                    | 5105 356     | Fe        | 0000                    |
| 5095 840    |           | 0000                    | 5105 536     |           | 000                     |
| 5096 031    |           | 000                     | 5105 718 s   |           | 4                       |

88 *TABLE OF SOLAR SPECTRUM WAVE-LENGTHS*

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 5105 918    |           | 0000                    | 5117 071    |           | 000                     |
| 5106 183    |           | 0000 N                  | 5117 334    |           | 0000                    |
| 5106 407    |           | 0000                    | 5117 933    |           | 0000                    |
| 5106 556    |           | 0000                    | 5118 112    | Mn        | 00                      |
| 5106 623    |           | 000                     | 5118 241    |           | 0000                    |
| 5106 773    |           | 000                     | 5118 352    |           | 0000                    |
| 5107 047    |           | 0000                    | 5118 529    |           | 0000                    |
| 5107 619    | Fe        | 4                       | 5118 987    |           | 000 Nd?                 |
| 5107 823    | Fe        | 4                       | 5119 292    |           | 00                      |
| 5108 056    |           | 000                     | 5119 368    |           | 0000                    |
| 5108 149    |           | 0000                    | 5119 555    |           | 000                     |
| 5108 359    |           | 000                     | 5119 820    |           | 0000                    |
| 5108 563    |           | 00                      | 5119 942    |           | 0000                    |
| 5108 805    |           | 0000                    | 5120 084    |           | 0000                    |
| 5109 083    |           | 0000                    | 5120 276    |           | 0000                    |
| 5109 291    |           | 000 d?                  | 5120 516    |           | 000                     |
| 5109 475    |           | 0000                    | 5120 592    | Ti        | 0                       |
| 5109 601    | Ti        | 0000                    | 5120 802    |           | 000                     |
| 5109 827 s  | Fe        | 2                       | 5120 893    |           | 0000                    |
| 5110 188    |           | 0000                    | 5121 056    |           | 0000                    |
| 5110 574 s  | Fe        | 5 d                     | 5121 197    |           | 0000                    |
| 5110 938    | Cr        | 00                      | 5121 399    |           | 0000                    |
| 5111 138    |           | 0000                    | 5121 609    |           | 0000                    |
| 5111 426    |           | 0000                    | 5121 732    | } s       | Ni                      |
| 5111 539    |           | 000                     | 5121 825    |           | Fe                      |
| 5111 802    |           | 000                     | 5122 156    |           | 0000                    |
| 5111 912    |           | 0000                    | 5122 299    | Cr        | 000                     |
| 5112 049    |           | 000                     | 5122 481    |           | 0000                    |
| 5112 458    |           | 000                     | 5122 613    |           | 0000                    |
| 5112 663    |           | 0000                    | 5122 968    | Co        | 000                     |
| 5112 817    |           | 0000 N                  | 5123 178    |           | 000                     |
| 5112 944    |           | 0000                    | 5123 390    | Y         | 0                       |
| 5113 153    |           | 000                     | 5123 458    |           | 0000                    |
| 5113 298    | Cr        | 00                      | 5123 641    | Cr        | 000                     |
| 5113 424    |           | 0000                    | 5123 899    | Fe        | 3                       |
| 5113 617    | Ti        | 0                       | 5124 219    |           | 000                     |
| 5113 920    |           | 0000                    | 5124 364    |           | 0000                    |
| 5114 195    |           | 0000 N                  | 5124 560    |           | 000                     |
| 5114 431    |           | 000 N d?                | 5124 785    |           | 00                      |
| 5114 683    |           | 000 N d?                | 5124 939    |           | 0000                    |
| 5115 367    |           | 0000                    | 5125 300    | Fe        | 3                       |
| 5115 566 s  | Ni        | 2                       | 5125 423    | Ni        | 1                       |
| 5115 843    |           | 0000                    | 5125 645    |           | 0000                    |
| 5115 961    | Fe        | 0                       | 5126 012    |           | 0000                    |
| 5116 045    |           | 0000                    | 5126 167    |           | 0000                    |
| 5116 217    |           | 0000                    | 5126 371 s  | Fe Co     | 2                       |
| 5116 359    |           | 0000                    | 5126 680    |           | 000                     |
| 5116 643    |           | 0000                    | 5126 856    |           | 000                     |
| 5116 849    |           | 0000                    | 5127 035    |           | 000                     |
| 5116 944    |           | 000                     | 5127 187    |           | 0000                    |

| Wave length | Substance  | Intensity and Character | Wave length | Substance             | Intensity and Character |
|-------------|------------|-------------------------|-------------|-----------------------|-------------------------|
| 5127 360    | Fe, Ti     | 0000                    | 5138 036    | Fe<br>Fe<br>Cr        | 0000                    |
| 5127 533 s  |            | 3                       | 5138 130    |                       | 0000                    |
| 5127 858    |            | 00                      | 5138 279    |                       | 0000                    |
| 5128 051    |            | 0000                    | 5138 518    |                       | 0000                    |
| 5128 250    |            | 000                     | 5138 690    |                       | 0000                    |
| 5128 382    |            | 0000                    | 5138 890    |                       | 000                     |
| 5128 486    |            | 0000                    | 5139 037    |                       | 0000                    |
| 5128 660    |            | 000                     | 5139 189    |                       | 0000                    |
| 5128 807    |            | 0000                    | 5139 427 s  |                       | 4                       |
| 5129 080    |            | 000                     | 5139 644 s  |                       | 4                       |
| 5129 336    | Ti?        | 3                       | 5139 817    | Cr                    | 00                      |
| 5129 546    | Ni         | 2                       | 5140 094    |                       | 0000                    |
| 5129 805    | Fe         | 1                       | 5140 336    |                       | 0000                    |
| 5129 990    | Ni         | 0000                    | 5140 553    | C?                    | 0000                    |
| 5130 120    |            | 0000                    | 5140 992    |                       | 00                      |
| 5130 304    |            | 0000                    | 5141 193    |                       | 0000                    |
| 5130 543    |            | 00                      | 5141 386    |                       | 000                     |
| 5130 757    |            | 000                     | 5141 497    |                       | 0000                    |
| 5131 103    | Fe         | 0000                    | 5141 709    | Fe                    | 0000                    |
| 5131 478    |            | 000                     | 5141 918 s  |                       | 3                       |
| 5131 642    |            | 2                       | 5142 074    |                       | 0000                    |
| 5131 771    | C          | 0000                    | 5142 279    |                       | 0000                    |
| 5131 942    | Ni         | 1                       | 5142 458    |                       | 0000                    |
| 5132 338    | Fe         | 0000                    | 5142 693    | Fe                    | 4 d?                    |
| 5132 523    |            | 000                     | 5142 958 s  | Ni                    | 2                       |
| 5132 673    |            | 000                     | 5143 111 s  | Fe                    | 3                       |
| 5132 843    |            | 00                      | 5143 288    | C,-<br>Cr, C          | 0000                    |
| 5133 118    |            | 000                     | 5143 511    |                       | 000                     |
| 5133 209    |            | 0000                    | 5143 764    |                       | 000                     |
| 5133 364    |            | 000                     | 5143 901    |                       | 00                      |
| 5133 654    |            | 000                     | 5144 031    |                       | 0000                    |
| 5133 870 s  | Fe         | 4                       | 5144 203    |                       | 0000                    |
| 5133 988    | C          | 0000 N                  | 5144 543    |                       | 000 N                   |
| 5134 505    | C,-<br>C,- | 0000                    | 5144 758    |                       | 000                     |
| 5134 697    |            | 000                     | 5144 847    |                       | 00                      |
| 5134 849    |            | 0000                    | 5145 098    |                       | 0000                    |
| 5135 273    |            | 0000                    | 5145 271    | Fe                    | 1                       |
| 5135 355    |            | 0000                    | 5145 403    | Ti                    | 0000                    |
| 5135 752    |            | 000                     | 5145 636    |                       | 0                       |
| 5135 880    |            | 000                     | 5145 907    |                       | 0000 N                  |
| 5136 103    | Fe         | 0000                    | 5146 291    | C,-                   | 00                      |
| 5136 270    |            | 00                      | 5146 486    | Ni                    | 000                     |
| 5136 443    |            | 000                     | 5146 659 s  |                       | 3                       |
| 5136 625    |            | 0000                    | 5146 945    | Co                    | 000 d?                  |
| 5136 835    |            | 0000                    | 5147 273    | Ti<br>C,<br>C,-<br>Fe | 000                     |
| 5136 969    | Ni         | 000                     | 5147 458    |                       | 0000 N                  |
| 5137 250    |            | 3                       | 5147 652    |                       | 0                       |
| 5137 558    |            | 3                       | 5147 871    |                       | 000                     |
| 5137 753    |            | 000                     | 5147 992    |                       | 000                     |
| 5137 864    | C,-        | 000                     | 5148 222    |                       | 2                       |

# PRELIMINARY TABLE OF SOLAR SPECTRUM WAVE-LENGTHS VIII

By HENRY A. ROWLAND

| Wave length | Substance          | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|--------------------|-------------------------|-------------|-----------|-------------------------|
| 5148 410    | Fe                 | 3                       | 5157.376    |           | 0000                    |
| 5148 627    |                    | 0000                    | 5157 783    | -,C'      | 0000                    |
| 5148 851    |                    | 000                     | 5157 915    | C,        | 0000                    |
| 5149 013    |                    | 000                     | 5158.152    |           | 000                     |
| 5149 267    | C,                 | 000                     | 5158.701    | (         | 0000                    |
| 5149 392    |                    | 000                     | 5158.832    | C'        | 0000                    |
| 5149 512    |                    | 0000                    | 5159 026    |           | 0000 N                  |
| 5149 685    |                    | 0000 N                  | 5159 231 s  | Fe        | 2                       |
| 5149 964    |                    | 000                     | 5159 452    |           | 0000                    |
| 5150 363    |                    | 00                      | 5159.634    | C,        | 0000                    |
| 5150 525    |                    | 0000                    | 5159.776    | C         | 0000                    |
| 5150 736    | ,C                 | 000                     | 5159.946    |           | 0000                    |
| 5150 842    | C?                 | 0000                    | 5160.138    |           | 000                     |
| 5151 020 s  | Fe                 | 4                       | 5160.419    | C,        | 00 N                    |
| 5151 112    | Mn                 | 000                     | 5160.554    |           | 0000                    |
| 5151 344    |                    | 0000 N                  | 5161 006    |           | 0000 N                  |
| 5151 628    |                    | 0000 N                  | 5161 194    | C,        | 000                     |
| 5152 087    | Fe                 | 3                       | 5161 353    | C,        | 0000                    |
| 5152 361    | Ti                 | 0                       | 5161 849    | C'        | 0000                    |
| 5152 700    |                    | 0000                    | 5161.910    | C,        | 000                     |
| 5153 129    | -C?                | 000                     | 5162.153    | C?        | 0000                    |
| 5153 337    | C                  | 0000                    | 5162 449 h  | Fe, C'    | 5                       |
| 5153 414    | Fe f <sub>ca</sub> | 1                       | 5162 690    | C         | 0000                    |
| 5153 584    |                    | 00                      | 5162.902    |           | 0000                    |
| 5153 687    |                    | 00                      | 5163.074    | C,        | 0000                    |
| 5153 848    |                    | 000                     | 5163.200    | C,-       | 000                     |
| 5153 985    |                    | 0000 Nd?                | 5163.327    |           | 0000                    |
| 5154 244 s  | Ti Co              | 2                       | 5163.585    | C,-       | 000                     |
| 5154 505    | C                  | 0000                    | 5163.756    | C,-       | 000                     |
| 5154 579    |                    | 000                     | 5164.007    |           | 0000                    |
| 5154 913    |                    | 0000                    | 5164.172    | C         | 0000                    |
| 5155 028    |                    | 0000                    | 5164.404    | C,-       | 000                     |
| 5155 303    | Ni                 | 1                       | 5164 562    |           | 0000                    |
| 5155 694    | C,-                | 000                     | 5164.724    | Fe?       | 1                       |
| 5155 935 s  | Ni                 | 2                       | 5164.855    | C         | 0000                    |
| 5156.239    |                    | 000                     | 5164 950    | C         | 0000                    |
| 5156 530    |                    | 000                     | 5165.080    | C,        | 000                     |
| 5156 728    | C                  | 0000                    | 5165.209    | C         | 0000                    |
| 5156 823    | C,-                | 00 N                    | 5165.297    | C         | 0000                    |
| 5157 163    |                    | 0000                    | 5165.416 s  | C         | 0000                    |

\* Head of carbon band.

TABLE OF SOLAR SPECTRUM WAVE-LENGTHS 91

| Wave length               | Substance | Intensity and Character | Wave length               | Substance  | Intensity and Character |
|---------------------------|-----------|-------------------------|---------------------------|------------|-------------------------|
| 5165 588 s                | Fe        | 2                       | 5180 747                  |            | 000                     |
| 5165 746                  |           | 0000                    | 5181 041                  |            | 0000                    |
| 5166 133                  |           | 0000                    | 5181 334                  |            | 000                     |
| 5166 454                  | Cr-Fe     | 3                       | 5181 498                  |            | 00                      |
| b <sub>4</sub> 5167 497 s | Mg        | 15                      | 5181 719                  |            | 0000 N                  |
| 5167 678 s                | Fe        | 5                       | 5182 010                  |            | 000                     |
| 5167 885                  |           | 00                      | 5182 123                  |            | 0000                    |
| 5168 123                  |           | 0000                    | 5182 518                  |            | 0000                    |
| 5168 360                  |           | 000 Nd?                 | 5182 761                  |            | 0000                    |
| 5168 832                  | Ni        | 1                       | 5182 907                  |            | 000                     |
| b <sub>8</sub> 5169 069 s | Fe        | 3                       | b <sub>1</sub> 5183 791 s | Mg         | 30                      |
| 5169 220 s                | Fe        | 4                       | 5184 364                  |            | 000                     |
| 5169 469                  |           | 00                      | 5184 445                  | Fe         | 2                       |
| 5169 664                  |           | 0000                    | 5184 738                  | Fe, Ni, Cr | 1                       |
| 5169 871                  |           | 0000                    | 5184 998                  |            | 0000                    |
| 5170 271                  |           | 0000                    | 5185 201                  |            | 0000                    |
| 5170 655                  |           | 0000                    | 5186 073                  | Ti         | 2                       |
| 5170 767                  |           | 000                     | 5186 274                  |            | 0000                    |
| 5170 937                  | Fe        | 0                       | 5186 497                  | Fe         | 000 N                   |
| 5171 192                  |           | 0000                    | 5186 718                  |            | 000                     |
| 5171 778 s                | Fe        | 6                       | 5187 432                  |            | 0000                    |
| 5172 386                  |           | 00                      | 5187 620                  |            | 000                     |
| b <sub>8</sub> 5172 856 s | Mg        | 20                      | 5188 004                  |            | 0000                    |
| 5173 499                  |           | 0000                    | 5188 079                  | Fe         | 1                       |
| 5173 652                  |           | 000                     | 5188 227                  |            | 0000                    |
| 5173 917 s                | Li        | 2                       | 5188 409                  |            | 0000                    |
| 5174 077                  |           | 0000                    | 5188 571                  |            | 0000                    |
| 5174 203                  |           | 000                     | 5188 863 s                | Ti         | 2                       |
| 5174 595                  |           | 000 N                   | 5189 018 s                | Ca         | 3                       |
| 5175 099                  |           | 000                     | 5189 300                  |            | 000                     |
| 5175 423                  |           | 000                     | 5189 503                  |            | 0000                    |
| 5175 575                  |           | 000                     | 5189 744                  |            | 000                     |
| 5175 923                  |           | 000 Nd?                 | 5189 948                  |            | 000                     |
| 5176 191                  | Co        | 000                     | 5191 244                  |            | 000                     |
| 5176 305                  |           | 000                     | 5191 629                  | Fe         | 4                       |
| 5176 735                  | Ni        | 1                       | 5191 768                  |            | 000                     |
| 5176 954                  | V         | 000                     | 5191 911                  |            | 0000                    |
| 5177 179                  |           | 0000 N                  | 5192 033                  |            | 0000                    |
| 5177 410                  | Fe        | 0                       | 5192 155                  | Cr         | 00                      |
| 5177 577                  | Co        | 00                      | 5192 523                  | Fe         | 5                       |
| 5177 784                  |           | 0000                    | 5192 659                  |            | 000                     |
| 5177 979                  |           | 0000                    | 5192 785                  |            | 000                     |
| 5178 156                  |           | 0000                    | 5192 924                  |            | 0000 N                  |
| 5178 644                  |           | 000                     | 5193.139 s                | Ti         | 2                       |
| 5178 970                  |           | 00                      | 5193 339                  |            | 0000                    |
| 5179 293                  |           | 000                     | 5193 500                  |            | 0000                    |
| 5179 695                  |           | 0000                    | 5193 669                  | Cr         | 000                     |
| 5179 958                  |           | 000                     | 5194 027                  |            | 0000                    |
| 5180 233                  | Fe        | 1                       | 5194 216                  | Ti         | 000                     |
| 5180 572                  |           | 000                     | 5195 113                  | Fe         | 4                       |

| Wave length  | Substance | Intensity and Character | Wave length | Substance  | Intensity and Character |
|--------------|-----------|-------------------------|-------------|------------|-------------------------|
| 5195 647     | Fe        | 2                       | 5210 555 s  | Ti         | 3                       |
| 5196 227     | Fe        | 1                       | 5211 015    |            | 000                     |
| 5196 434     |           | 0000 N                  | 5211 106    |            | 0000                    |
| 5196 613     | Cr        | 0                       | 5211 367    |            | 000                     |
| 5196 741     | Mn        | 00                      | 5211 700    | Fe         | 00                      |
| 5197 332     | Ni, Mn    | 00                      | 5211 976    |            | 0000                    |
| 5197 540     |           | 0000 N                  | 5212 398    |            | 000 N                   |
| 5197 743     |           | 2                       | 5212 503    |            | 0000                    |
| 5197 954     |           | 0000                    | 5212 859    |            | 0000                    |
| 5198 108     |           | 0                       | 5213 155    |            | 000 Nd?                 |
| 5198 512     |           | 0000                    | 5213 515    |            | 0000                    |
| 5198 888 s   | Fe        | 3                       | 5213 977    |            | 000                     |
| 5199 033     |           | 0000                    | 5214 286    | Cr         | 00                      |
| 5199 766     |           | 000                     | 5214 781    |            | 00                      |
| 5199 879     |           | 000                     | 5215 353 s  | Fe         | 3                       |
| 5200 355     | Cr        | 00                      | 5215 737    |            | 000 N                   |
| 5200 590     | V         | 0                       | 5216 437    | Fe         | 3                       |
| 5200 989     |           | 0000 N                  | 5216 648    |            | 00                      |
| 5201 260     | Ti        | 000                     | 5217 552 s  | Fe         | 3                       |
| 5201 458     |           | 0000 N                  | 5217 836    |            | 0000 N                  |
| 5201 771     |           | 0000 N                  | 5218 030    |            | 0000                    |
| 5202 125     |           | 000                     | 5218 085    | Fe         | 0                       |
| 5202 249     |           | 000                     | 5218 369    | Fe         | 1                       |
| 5202 439 } s | Fe?       | 2                       | 5218 675    |            | 0000                    |
| 5202 516 }   | Fe        | 4                       | 5219 186    |            | 0000                    |
| 5202 945     |           | 0000                    | 5219 875    | Ti         | 0                       |
| 5203 118     |           | 0000                    | 5220 045    |            | 0000                    |
| 5203 658     |           | 000                     | 5220 250    |            | 000                     |
| 5204 414     |           | 0000                    | 5220 358    | Ni         | 0                       |
| 5204 680 } s | Cr        | 5                       | 5221 078    |            | 000                     |
| 5204 768 }   | Fe        | 3                       | 5221 197    | Cr         | 00                      |
| 5205 113     |           | 0000                    | 5221 928    | Cr         | 0                       |
| 5205 467     |           | 0000                    | 5222 556    | Cr         | 00                      |
| 5205 897     | V         | 0                       | 5222 849    | Ti, Cr     | 00                      |
| 5206 215     | Cr Ti     | 5                       | 5223 033    |            | 0000 N                  |
| 5206 372     |           | 00                      | 5223 351    | Fe         | 0                       |
| 5206 712     |           | 000                     | 5223 529    | Ti         | 0000                    |
| 5206 986     |           | 0000                    | 5223 705    |            | 0000                    |
| 5207 259     |           | 0000                    | 5223 791    |            | 000                     |
| 5207 791     |           | 000 N                   | 5224 062    |            | 0000 Nd?                |
| 5208 038     |           | 0000                    | 5224 239    | Cr         | 000 N                   |
| 5208 111     | Ti        | 00                      | 5224 471    | Ti         | 0                       |
| 5208 276     |           | 000                     | 5224 712    | Ti, Cr     | 00                      |
| 5208 596     | Cr        | 5                       | 5224 885    |            | 0000                    |
| 5208 776     | Fe        | 2                       | 5225 101    | Cr         | 0                       |
| 5209 779 x   |           | 0000                    | 5225 198    | Cr, Ti, Fe | 00                      |
| 5209 949     |           | 0000                    | 5225 513    |            | 0000                    |
| 5210 059     |           | 000                     | 5225 695 s  | Fe         | 2                       |
| 5210 204     |           | 0000                    | 5225 877    |            | 0000                    |
| 5210 421     |           | 0000                    | 5225 974    | Cr         | 000                     |



| Wave length | Substance         | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-------------------|-------------------------|-------------|-----------|-------------------------|
| 5226 224    |                   | 0000                    | 5242 658 s  | Fe        | 2                       |
| 5226 364    |                   | 0000                    | 5243 346    |           | 000                     |
| 5226 549    |                   | 0000                    | 5243 526    | Cr        | 00                      |
| 5226 707    | Γ <sub>1</sub> -  | 2                       | 5243 635    |           | 0000                    |
| 5227 043    | Fe-C <sub>1</sub> | 3                       | 5243 946    | Fe        | 1                       |
| 5227 362    | Fe                | 5 d?                    | 5244 702    |           | 000 N                   |
| 5227 639    |                   | 0000                    | 5245 118    |           | 0000                    |
| 5227 902    |                   | 000                     | 5245 801    |           | 0000                    |
| 5228 049    |                   | 0000                    | 5245 901    |           | 0000                    |
| 5228 268    | Cr                | 000                     | 5246 170    |           | 0000                    |
| 5228 546    |                   | 1                       | 5246 310    |           | 0000                    |
| 5228 727    |                   | 0000                    | 5246 733    |           | 0000                    |
| 5230 030 s  | Fe                | 4                       | 5246 946    |           | 000                     |
| 5230 225    |                   | 0000                    | 5247 229    | Fe        | 1                       |
| 5230 382    | Co, Cr            | 00                      | 5247 466    | Ti        | 000                     |
| 5230 554    |                   | 0000                    | 5247 737    | Cr        | 2                       |
| 5230 867    |                   | 000 N                   | 5248 091    | Co        | 000 N                   |
| 5231 151    |                   | 0000                    | 5248 550    |           | 000                     |
| 5231 578    |                   | 000                     | 5249 163    |           | 0000                    |
| 5232 681    |                   | 000                     | 5249 279    | Fe        | 00                      |
| 5233 005    |                   | 0000                    | 5249 593    |           | 0000                    |
| 5233 122 s  | Fe                | 7                       | 5249 751    |           | 0000                    |
| 5234 022    |                   | 0000                    | 5250 193    |           | 0000                    |
| 5234 255    |                   | 0000                    | 5250 385 s  | Fe        | 2                       |
| 5234 380    |                   | 000                     | 5250 602    |           | 0000 N                  |
| 5234 603    |                   | 0000 N                  | 5250 817 s  | Fe        | 3                       |
| 5234 791    | 1-2               | 2                       | 5251 085    |           | 0000 N                  |
| 5235 040    |                   | 0000                    | 5252 146    | Fe        | 0                       |
| 5235 202    |                   | 0000                    | 5252 276    | Ti        | 000                     |
| 5235 353    | Co                | 000                     | 5253 205    |           | 00                      |
| 5235 557    | Fe                | 1                       | 5253 421    |           | 0000                    |
| 5235 672    | Ni                | 00                      | 5253 633 s  | Fe        | 2                       |
| 5236 373    |                   | 0                       | 5253 854    |           | 0000 N                  |
| 5236 549    |                   | 000                     | 5254 132    |           | 0000 N                  |
| 5237 254    |                   | 0000                    | 5254 830    |           | 0000                    |
| 5237 493    | Cr?               | 1                       | 5255 121    | Fe        | 3                       |
| 5238 011    |                   | 0000                    | 5255 295    | Cr        | 0                       |
| 5238 416    |                   | 0000                    | 5255 492    | Mn        | 0 d?                    |
| 5238 742    | Ti                | 000 N                   | 5255 687    |           | 0000                    |
| 5239 137    | Cr                | 00                      | 5255 831    |           | 000                     |
| 5239 992    |                   | 1                       | 5255 912    |           | 000                     |
| 5240 310    |                   | 0000                    | 5255 973    | Ti        | 0000                    |
| 5240 523    |                   | 0000                    | 5257 100    | Sr?       | 00                      |
| 5240 639    |                   | 000                     | 5257 246    |           | 0000 N                  |
| 5241 040    |                   | 000                     | 5257 529    |           | 0000 N                  |
| 5241 347    |                   | 0000                    | 5257 814    |           | 0                       |
| 5241 624    |                   | 0000                    | 5258 000    |           | 000 N                   |
| 5242 094    |                   | 0000                    | 5259 261    |           | 0000 N                  |
| 5242 238    |                   | 000                     | 5259 660    |           | 000 N                   |
| 5242 450    |                   | 0000 N                  | 5259 912    |           | 0000                    |

| Wave length               | Substance | Intensity and Character | Wave length  | Substance | Intensity and Character |
|---------------------------|-----------|-------------------------|--------------|-----------|-------------------------|
| 5260 142                  |           | 000                     | 5270 235     |           | 000                     |
| 5260 438                  |           | 0000                    | 5270 438 s * | Ca        | 3                       |
| 5260 561 s                | Ca        | 0                       | 5270 558 s   | Fe        | 4                       |
| 5260 840                  |           | 0000                    | 5271 228     |           | 00                      |
| 5260 945                  |           | 0000                    | 5271 464     |           | 00                      |
| 5261 669                  |           | 0000                    | 5271 796     |           | 0000                    |
| 5261 876 s                | Ca Cr     | 3                       | 5272 017     |           | 0000                    |
| 5262 130                  |           | 000 N d?                | 5272 171     | Cr        | 00                      |
| 5262 321 s                |           | 1                       | 5272 436     | Fe        | 000                     |
| 5262 419 s                | Ca        | 3                       | 5272 574     |           | 000                     |
| 5262 631                  |           | 0000                    | 5273 339 s   | Fe        | 3                       |
| 5262 791                  |           | 000                     | 5273 558 s   | Fe Cr     | 2                       |
| 5263 056                  |           | 00                      | 5273 770     |           | 0000 N                  |
| 5263 239                  |           | 0000                    | 5274 408     |           | 00                      |
| 5263 486                  | Fe        | 4                       | 5274 575     |           | 000                     |
| 5263 669                  | Ti        | 000                     | 5274 702     |           | 00                      |
| 5263 890                  |           | 000                     | 5274 959     |           | 0000 N                  |
| 5264 038                  | Fe        | 0                       | 5275 148     |           | 0                       |
| 5264 163                  |           | 0000                    | 5275 340     | Cr        | 00                      |
| 5264 329 s                | Cr        | 4                       | 5275 454     |           | 1                       |
| 5264 415 s                | Ca        | 3                       | 5275 641     |           | 0000 N                  |
| 5264 570                  |           | 000                     | 5275 762     |           | 0000                    |
| 5264 759                  |           | 000 N d?                | 5275 926     | Cr        | 1                       |
| 5264 976                  | Fe        | 0                       | 5276 169 } s | Fe?       | 3                       |
| 5265 146                  |           | 0000 N                  | 5276 237 }   | -Cr?      | 2                       |
| 5265 321                  | Cr        | 00                      | 5276 344     | Co        | 000                     |
| 5265 423                  |           | 000                     | 5276 612     |           | 0000 N                  |
| 5265 591                  | Co        | 0000                    | 5277 047     |           | 000                     |
| 5265 729 s                | Ca        | 3                       | 5277 480     |           | 00                      |
| 5265 893 s                | Ni-Cr     | 2                       | 5278 420     |           | 00 N                    |
| 5266 141                  | Ti        | 0                       | 5278 747     |           | 0000                    |
| 5266 246                  |           | 000 N                   | 5278 960     |           | 00                      |
| 5266 482                  |           | 000                     | 5279 130     |           | 000                     |
| 5266 639                  |           | 000                     | 5279 349     |           | 0000                    |
| 5266 738 s                | Fe        | 6                       | 5279 481     |           | 000                     |
| 5267 203                  |           | 000                     | 5279 843     |           | 00                      |
| 5267 273                  |           | 000                     | 5280 048     |           | 0                       |
| 5267 447                  |           | 00                      | 5280 239     |           | 00                      |
| 5267 658                  |           | 0000                    | 5280 458     | Cr        | 000                     |
| 5267 825                  |           | 000 N                   | 5280 540     | Fe        | 1                       |
| 5268 355                  |           | 0000                    | 5280 799     | Co        | 00                      |
| 5268 515                  | Ni        | 0                       | 5281 099     |           | 0000 Nd?                |
| 5268 670                  |           | 000                     | 5281 333     |           | 000                     |
| 5268 784                  | Co        | 00                      | 5281 491     |           | 00 N                    |
| 5268 972                  |           | 0000                    | 5281 681     |           | 000 N                   |
| 5269 125                  |           | 000                     | 5281 844     |           | 000                     |
| 5269 586                  |           | 00 N                    | 5281 971 s   | Fe        | 5                       |
| 5269 723 s E <sub>2</sub> | Fe        | 8 d?                    | 5282 339     |           | 0000                    |
| 5269 863                  |           | 000 N                   | 5282 576     | Ti        | 00                      |
| 5270 076                  |           | 0000                    | 5283 331     |           | 0000                    |

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 5283 613    | Ti, Co    | 00                      | 5300 152    |           | 00                      |
| 5283 802 s  | Fe        | 6                       | 5300 578    |           | 000                     |
| 5284 087    |           | 000                     | 5300 735    |           | 0000                    |
| 5284 281    | Ti        | 1                       | 5300 929 s  | Cr        | 2                       |
| 5284 453    |           | 0000                    | 5301 094    |           | 0000                    |
| 5284 601    | Fe, Ti    | 00                      | 5301 218    | Co        | 00                      |
| 5284 787    |           | 00                      | 5301 485    |           | 000                     |
| 5284 940    |           | 0000                    | 5301 666    |           | 0000                    |
| 5285 300    | Ni        | 0                       | 5302 048    |           | 000                     |
| 5285 431    |           | 000                     | 5302 225    |           | 000                     |
| 5285 557    |           | 0000                    | 5302 480    | Fe        | 5                       |
| 5285 819    |           | 000                     | 5302 738    |           | 0000                    |
| 5287 351    | Cr        | 000                     | 5302 829    |           | 000                     |
| 5287 741    |           | 0000 N                  | 5303 122    |           | 0000                    |
| 5287 958    |           | 000                     | 5303 401    |           | 0                       |
| 5288 389    |           | 000                     | 5303 591    |           | 000                     |
| 5288 548    |           | 0000                    | 5303 738    |           | 000                     |
| 5288 705 s  | Fe        | 2                       | 5304 018    |           | 00                      |
| 5288 974    |           | 000                     | 5304 355    | Cr        | 0                       |
| 5289 446    |           | 000                     | 5304 610    |           | 0000                    |
| 5289 676    |           | 000                     | 5304 735    |           | 000                     |
| 5289 988    |           | 000                     | 5305 167    |           | 000 d                   |
| 5290 984    |           | 000                     | 5305 602    |           | 0000                    |
| 5291 820    |           | 000 N                   | 5306 040    |           | 0                       |
| 5292 388    | Awv?      | 000 N                   | 5306 331    |           | 0000                    |
| 5292 569    |           | 0000                    | 5306 665    |           | 000                     |
| 5292 762    | Fe        | 0                       | 5307 039    |           | 0000                    |
| 5293 044    |           | 000                     | 5307 140    |           | 0000                    |
| 5293 210    | Awv?      | 00                      | 5307 402    |           | 000                     |
| 5293 341    | Awv?      | 00                      | 5307 541 s  | Fe        | 3                       |
| 5293 543    |           | 000                     | 5308 385    |           | 0000                    |
| 5293 946    |           | 0000                    | 5308 599    |           | 0                       |
| 5294 134    | Fe        | 0                       | 5308 863    |           | 00                      |
| 5294 290    |           | 0000                    | 5309 064    |           | 000                     |
| 5294 579    |           | 0000                    | 5309 357    |           | 0000                    |
| 5294 726    |           | 00                      | 5309 630    |           | 0000                    |
| 5295 241    |           | 0000                    | 5310 227    |           | 0000                    |
| 5295 485    | Fe        | 0                       | 5310 417    |           | 000                     |
| 5295 955    | Awv?      | 00                      | 5310 659    |           | 000                     |
| 5296 243    |           | 000                     | 5310 866    |           | 0                       |
| 5296 657    |           | 0000                    | 5311 102    |           | 000                     |
| 5296 872 s  | Cr        | 3                       | 5311 310    |           | 0000                    |
| 5297 407    | Cr, Ti    | 000                     | 5311 650    |           | 000                     |
| 5297 555    | Cr        | 2                       | 5311 804    |           | 000                     |
| 5298 194    | Cr        | 1                       | 5311 962    |           | 000                     |
| 5298 455    | Cr        | 4                       | 5312 435    |           | 000                     |
| 5298 672    | Ti        | 0                       | 5312 666    |           | 000                     |
| 5298 957    | Fe        | 0                       | 5312 835    |           | 00                      |
| 5299 005    |           | 0000                    | 5313 031    | Cr        | 0                       |
| 5299 804    |           | 0000                    | 5313 253    |           | 000                     |

| Wave length  | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|--------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 5313 422     | Co        | 000 N                   | 5328 747    | Fe        | 2                       |
| 5313 587     |           | 000                     | 5328 919    |           | 0000                    |
| 5313 758     |           | 1                       | 5329 096    |           | 000 d?                  |
| 5313 931     |           | 0000                    | 5329 329    | Cr        | 3                       |
| 5314 447     | Fe        | 0000 N                  | 5329 975    | Cr        | 0                       |
| 5314 916     |           | 000 N                   | 5330 179    | Fe        | 2                       |
| 5315 103     |           | 000                     | 5330 748    |           | 000                     |
| 5315 252     |           | 1                       | 5331 377    |           | 0000                    |
| 5315 960     | Fe        | 000 N                   | 5331 641    | Co        | 00 d                    |
| 5316 390     |           | 0000                    | 5331 944    |           | 000                     |
| 5316 572     |           | 0000                    | 5332 545    |           | 000                     |
| 5316 790 s   | Fe        | 4                       | 5332 849    | Co, Fe    | 1                       |
| 5316 906 } s | Co        | 0                       | 5333 089 s  | Fe        | 4                       |
| 5316 958 }   |           | 2                       | 5333 334    |           | 000                     |
| 5317 249     |           | 0000                    | 5333 432    |           | 000                     |
| 5317 724     |           | 00 N d?                 | 5333 832    | Co        | 000                     |
| 5318 215     |           | 0000                    | 5333 949    |           | 000                     |
| 5318 534     |           | 00 N                    | 5334 140    |           | 0000                    |
| 5318 777     | Cr, Fe    | 0000                    | 5334 403    |           | 000                     |
| 5318 955     |           | 0                       | 5334 520    |           | 000                     |
| 5319 225     |           | 00                      | 5335 050    | Co        | 1                       |
| 5319 392     |           | 000                     | 5335 147    |           | 0000                    |
| 5319 502     | Fe        | 000                     | 5335 547    |           | 0000                    |
| 5319 999     |           | 00                      | 5335 770    |           | 0000                    |
| 5320 220     |           | 0                       | 5336 356    |           | 000                     |
| 5321 005     |           | 000 N                   | 5336 478    |           | 0000                    |
| 5321 293     | Fe        | 2                       | 5336 660    |           | 0000                    |
| 5321 976     | Mn        | 000 N d?                | 5336 792    |           | 0000 N                  |
| 5322 227     | Fe        | 3                       | 5336 974    | Th-       | 4                       |
| 5322 994     |           | 000                     | 5337 910    |           | 0                       |
| 5323 687     |           | 0000                    | 5337 946    |           | 00                      |
| 5323 971     |           | 0000                    | 5338 517    |           | 00 N                    |
| 5324 274     |           | 0000                    | 5338 727    |           | 000                     |
| 5324 373 s   | Fe        | 7                       | 5338 927    |           | 000                     |
| 5324 881     | Co        | 0000                    | 5339 403    |           | 000                     |
| 5325 460     |           | 00                      | 5339 609    | Co        | 00                      |
| 5325 569     |           | 0000                    | 5339 719    |           | 000                     |
| 5325 738     |           | 2                       | 5339 878    |           | 0000                    |
| 5326 139     | Fe        | 000 N                   | 5340 121    | Fe        | 6                       |
| 5326 331     |           | 1                       | 5340 375    | Co        | 00                      |
| 5326 535     |           | 0000                    | 5340 639    | Cr        | 0                       |
| 5326 682     |           | 0000                    | 5340 852    |           | 000                     |
| 5327 003     |           | 00                      | 5340 962    |           | 0000                    |
| 5327 445     |           | 000                     | 5341 213    | Fe        | 7                       |
| 5327 917     |           | 0000                    | 5341 337    | Mn        | 1                       |
| 5328 074     | Fe        | 00                      | 5341 514    |           | 00                      |
| 5328 236     |           | 8 d?                    | 5341 670    |           | 000                     |
| 5328 367     |           | 000                     | 5341 933    |           | 0000                    |
| 5328 515     | Cr        | 2                       | 5342 055    |           | 0000                    |
| 5328 696     | Fe        | 2                       | 5342 276    |           | 000                     |

747

↑  
 5313 422 is not listed.

TABLE OF SOLAR SPECTRUM WAVE-LENGTHS 97

| Wave length | Substance | Intensity and Character | Wave length  | Substance | Intensity and Character |
|-------------|-----------|-------------------------|--------------|-----------|-------------------------|
| 5342 409    |           | 000                     | 5357 383     |           | 00                      |
| 5342 713    |           | 000 d                   | 5358 306     |           | 00                      |
| 5342 890    | Co        | 1                       | 5358 476     |           | 0000                    |
| 5343 148    |           | 0000                    | 5358 668     |           | 0000                    |
| 5343 310    |           | 0000                    | 5358 853     |           | 000                     |
| 5343 411    |           | 0000                    | 5359 127     |           | 000 N                   |
| 5343 570    | Co        | 0                       | 5359 389     | Co        | 00                      |
| 5343 622    | Fe        | 2                       | 5359 714     |           | 000                     |
| 5344 646    | Mn        | 00                      | 5359 910     |           | 000                     |
| 5344 767    |           | 000 N                   | 5360 330     |           | 0000 N                  |
| 5344 942    | Ci        | 00                      | 5360 665     |           | 0000                    |
| 5345 729    |           | 000                     | 5360 903     |           | 0000                    |
| 5345 991    | Ci        | 5                       | 5361 115     |           | 0000                    |
| 5346 274    |           | 00                      | 5361 343     |           | 0000                    |
| 5346 523    |           | 000                     | 5361 565     |           | 000                     |
| 5346 731    | Fe        | 0                       | 5361 697     |           | 000                     |
| 5347 004    |           | 00                      | 5361 813 s   |           | 1                       |
| 5347 156    |           | 0000                    | 5362 365     |           | 0000                    |
| 5347 277    |           | 000                     | 5362 944 s   | Fe, Co    | 1                       |
| 5347 500    |           | 0000                    | 5363 058 s   |           | 3                       |
| 5347 712    |           | 00                      | 5364 359     |           | 000                     |
| 5347 898    |           | 00                      | 5364 615     |           | 000                     |
| 5348 259    |           | 000                     | 5365 069     | Fe        | 5                       |
| 5348 511    | Cr        | 4                       | 5365 416     |           | 0000                    |
| 5348 947    |           | 000                     | 5365 596     | Fe        | 3                       |
| 5349 283    |           | 000                     | 5366 616     |           | 00                      |
| 5349 473    |           | 0000                    | 5366 827     |           | 000                     |
| 5349 653 s  | Ca        | 4                       | 5366 950     |           | 000                     |
| 5349 928    | Fe        | 1                       | 5367 669 s   | Fe        | 6                       |
| 5350 059    | Mn        | 00                      | 5367 062     |           | 0000                    |
| 5350 281    |           | 00                      | 5368 083     |           | 0000                    |
| 5350 547    |           | 00                      | 5368 311     |           | 0000                    |
| 5350 688    |           | 0000 N                  | 5368 490     |           | 000                     |
| 5350 976    |           | 0000 N d?               | 5368 626     |           | 000                     |
| 5351 261    | Ti        | 00                      | 5368 741     |           | 000                     |
| 5351 832    |           | 0000                    | 5369 044     |           | 0000                    |
| 5352 024    |           | 000                     | 5369 125     |           | 0000                    |
| 5352 234    | Co        | 1                       | 5369 348     |           | 0000 N                  |
| 5352 421    |           | 0000                    | 5369 550     |           | 000                     |
| 5352 591    |           | 000                     | 5369 782     | Co Ti     | 1                       |
| 5353 178    |           | 000                     | 5370 166 s   | Fe        | 6                       |
| 5353 350    |           | 0000 N                  | 5370 522     | Ci        | 00 N                    |
| 5353 571 s  | Fe, Cr    | 3                       | 5371 528     | Ni        | 1                       |
| 5353 702    | Co        | 0                       | 5371 656 } s | Cr?       | 4                       |
| 5354 714    |           | 0000                    | 5371 734 }   | Fe        | 3                       |
| 5354 916    |           | 0000                    | 5372 121     |           | 000                     |
| 5355 088    |           | 0000                    | 5373 839     |           | 0000 N                  |
| 5355 921    |           | 00                      | 5373 905     | Fe, Cr    | 2                       |
| 5356 270    |           | 000                     | 5374 142     |           | 0000                    |
| 5357 178    |           | 000                     | 5374 349     |           | 000                     |

| Wave length | Substance | Intensity and Character | Wave length | Substance       | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------------|-------------------------|
| 5374 610    |           | 000                     | 5387 165    | Fe, Cl          | 0                       |
| 5374 962    |           | 000                     | 5387 323    |                 | 0000                    |
| 5375 086    |           | 0000                    | 5387 478    |                 | 000 N                   |
| 5375 371    |           | 000                     | 5387 680    | Fe              | 00                      |
| 5375 516    |           | 000                     | 5387 769    | Cr              | 00                      |
| 5376 068    |           | 000                     | 5387 926    |                 | 0000                    |
| 5376 320    |           | 000                     | 5388 192    |                 | 000                     |
| 5376 656    |           | 000                     | 5388 360    |                 | 0000                    |
| 5376 867    |           | 0000                    | 5388 550    |                 | 00                      |
| 5377 028    | Fe        | 0                       | 5388 713    |                 | 000                     |
| 5377 252    |           | 00                      | 5388 989    |                 | 000                     |
| 5377 388    |           | 000                     | 5389 371    |                 | 000                     |
| 5377 505    |           | 0000                    | 5389 505    |                 | 0000                    |
| 5377 606    |           | 0000                    | 5389 683 s  | Fe              | 3                       |
| 5377 800    | Mn        | 2 N                     | 5389 875    |                 | 0000                    |
| 5377 991    |           | 000                     | 5390 047    |                 | 00                      |
| 5378 122    |           | 0000                    | 5390 203    |                 | 000                     |
| 5378 426    |           | 000                     | 5390 573    | Cl              | 000                     |
| 5379 338    |           | 0000                    | 5390 725    |                 | 0                       |
| 5379 519    |           | 0000                    | 5390 974    |                 | 0000                    |
| 5379 625    |           | 0000                    | 5391 267    |                 | 0000                    |
| 5379 775 s  | Fe        | 3                       | 5391 660    | Fe              | 2                       |
| 5380 086    |           | 0000                    | 5391 820    | Fe              | 1                       |
| 5380 258    |           | 0000                    | 5391 990    |                 | 0000                    |
| 5380 516    |           | 0 N                     | 5392 212    |                 | 00 N                    |
| 5380 909    |           | 00 N d?                 | 5392 528    | Ni              | 00                      |
| 5381 221    | Fe        | 2                       | 5393 375 s  | Fe              | 5                       |
| 5381 362    |           | 0000                    | 5393 584    |                 | 000                     |
| 5381 514    | Co        | 0000                    | 5394 404    |                 | 0000                    |
| 5381 686    |           | 0000                    | 5394 551    |                 | 000                     |
| 5381 980    | Co        | 000                     | 5394 839    | Mn <sup>*</sup> | { 1                     |
| 5382 232    |           | 0000                    | 5394 913    |                 | { 1                     |
| 5382 469    |           | 0                       | 5395 209    |                 | 0000 N                  |
| 5382 951    |           | 0000                    | 5395 422    |                 | 0                       |
| 5383 209    |           | 000                     | 5395 668    |                 | 000                     |
| 5383 325    |           | 0000                    | 5396 196    |                 | 0000 N                  |
| 5383 578 s  | Fe        | 6                       | 5396 448    |                 | 00                      |
| 5383 963    |           | 0000                    | 5396 778    | Ni              | 000 N                   |
| 5384 267    |           | 0000                    | 5396 935    |                 | 000                     |
| 5384 398    |           | 0000                    | 5397 107    |                 | 000                     |
| 5384 833    |           | 000                     | 5397 344 s  | Fe              | 7 d?                    |
| 5385 071    |           | 0000                    | 5397 822    | Fe              | 1                       |
| 5385 329    |           | 000                     | 5397 993    |                 | 0000                    |
| 5385 501    |           | 0000                    | 5398 256    |                 | 0000                    |
| 5385 785    |           | 00                      | 5398 486    | Fe              | 3                       |
| 5386 089    |           | 000                     | 5399 065    |                 | 000                     |
| 5386 301    |           | 0000                    | 5399 675    | Mn              | 1 N d?                  |
| 5386 534    | Fe        | 1                       | 5399 974    |                 | 0000                    |
| 5386 797    |           | 0000 N                  | 5400 462    |                 | 0000 N                  |
| 5386 989    |           | 0000                    | 5400 624    |                 | 0000                    |

\*Compound lines measured as double in solar spectrum

| Wave length | Substance       | Intensity and Character | Wave length | Substance        | Intensity and Character |
|-------------|-----------------|-------------------------|-------------|------------------|-------------------------|
| 5400 711    | Fe              | 3                       | 5413 302    | A <sup>2</sup> * | 00 N                    |
| 5400 831    | Cl              | 0 N                     | 5413 616    |                  | 0000 N                  |
| 5401 472    |                 | 0                       | 5413 889    | Mn <sup>†</sup>  | 00 N                    |
| 5401 904    |                 | 000 N d?                | 5414 117    |                  | 0000                    |
| 5402 151    |                 | 0000                    | 5414 279    |                  | 00                      |
| 5402 273    | V               | 00                      | 5414 547    | A <sup>2</sup>   | 0000 N                  |
| 5402 799    |                 | 0000                    | 5415 083    |                  | 0000 N                  |
| 5402 982    | Y               | 0                       | 5415 416 s  | Fe V             | 5                       |
| 5403 670    |                 | 0000                    | 5416 282    |                  | 0000                    |
| 5404 028    | Fe              | 2                       | 5416 587    |                  | 0000                    |
| 5404 357    | Fe              | 5                       | 5417 247    | Fe               | 0                       |
| 5404 750    |                 | 00                      | 5418 357    |                  | 000 N                   |
| 5404 883    |                 | 00                      | 5418 463    |                  | 0000                    |
| 5405 047    |                 | 0000                    | 5418 979    | I <sup>1</sup> ? | 1                       |
| 5405 192    | Cr              | 00                      | 5419 136    | A?               | 0000                    |
| 5405 341    |                 | 000                     | 5419 313    | A?               | 0000                    |
| 5405 554    |                 | 1                       | 5419 421    | A?               | 0000                    |
| 5405 695    |                 | 0000                    | 5419 627    |                  | 0000                    |
| 5405 989 s  | Fe              | 6                       | 5420 113    |                  | 000                     |
| 5406 388    |                 | 0000 N                  | 5420 295    |                  | 0000 Nd?                |
| 5406 543    |                 | 00                      | 5420 510    | Mn <sup>†</sup>  | { 0 N                   |
| 5406 687    |                 | 0000                    | 5420 613    |                  | { 0 N                   |
| 5406 808    |                 | 0000                    | 5420 821    | A?               | 0000 N                  |
| 5406 980    |                 | 1                       | 5421 134    |                  | 00                      |
| 5407 243    |                 | 0000 N                  | 5421 381    |                  | 0 N                     |
| 5407 375    |                 | 0000 N                  | 5421 614    |                  | 000                     |
| 5407 587    | Mn <sup>†</sup> | { 0                     | 5421 783    |                  | 0000 N                  |
| 5407 688    |                 | { 0                     | 5422 049    |                  | 00                      |
| 5407 820    |                 | 00                      | 5422 370    |                  | 00                      |
| 5408 028    |                 | 0000 N                  | 5422 719    |                  | 0000                    |
| 5408 285    |                 | 0000 N                  | 5422 866    |                  | 0000                    |
| 5408 407    |                 | 0000 N                  | 5423 160    |                  | 0000                    |
| 5408 569    |                 | 0000 N                  | 5423 689    |                  | 000 N                   |
| 5408 792    |                 | 0000 N                  | 5423 802    |                  | 0000                    |
| 5409 024    |                 | 000                     | 5423 963    |                  | 000                     |
| 5409 131    |                 | 0000                    | 5424 170    |                  | 000 N                   |
| 5409 339    | Fe              | 2                       | 5424 290 s  | Fe               | 6                       |
| 5409 632    |                 | 0000 d?                 | 5424 406    |                  | 0000 N                  |
| 5409 823    | I <sup>1</sup>  | 000                     | 5424 761    |                  | 000                     |
| 5410 000 s  | Cr              | 4                       | 5424 860    | Ni               | 1                       |
| 5410 259    |                 | 0000 N                  | 5425 464    |                  | 1                       |
| 5410 633    |                 | 0000 N                  | 5425 832    |                  | 000                     |
| 5411 124    | Fe              | 4                       | 5426 474    |                  | 00                      |
| 5411 428    | Ni              | 1                       | 5427 036    |                  | 000 N                   |
| 5411 596    |                 | 000                     | 5427 431    |                  | 0000                    |
| 5411 764    |                 | 0000                    | 5428 018    |                  | 000                     |
| 5412 211    |                 | 000                     | 5428 534    |                  | 000                     |
| 5412 391    |                 | 0000                    | 5428 918    |                  | 000                     |
| 5412 779    |                 | 000                     | 5429 057    |                  | 000                     |
| 5412 997    | Mn              | 00                      | 5429 186    |                  | 0000                    |

\* Compound lines in both Mn and Sun

\* A means "atmospheric line"

# PRELIMINARY TABLE OF SOLAR SPECTRUM WAVE-LENGTHS IX

By HENRY A. ROWLAND

| Wave length | Substance       | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------------|-------------------------|-------------|-----------|-------------------------|
| 5429 349    |                 | 00                      | 5438 507    |           | 000                     |
| 5429 495    |                 | 0000                    | 5438 674    |           | 0000                    |
| 5429 637    |                 | 000                     | 5438 917    |           | 0000                    |
| 5429 717    |                 | 1                       | 5439 256    |           | 0000                    |
| 5429 911    | Fe              | 6 d?                    | 5439 506    |           | 0000                    |
| 5430 062    |                 | 0                       | 5439 676    |           | 0000                    |
| 5430 295    |                 | 0000 N                  | 5439 914    | A         | 000                     |
| 5430 572    |                 | 00                      | 5440 130    |           | 000                     |
| 5430 993    |                 | 0000                    | 5440 707    |           | 0000                    |
| 5431 266    |                 | 0000                    | 5440 861    |           | 000                     |
| 5431 590    |                 | 0000                    | 5441 031    |           | 0000                    |
| 5431 747    | A?              | 000                     | 5441 188    |           | 000                     |
| 5432 061    |                 | 0000                    | 5441 350    |           | 000                     |
| 5432 564    |                 | 000                     | 5441 549    | Fe?       | 1                       |
| 5432 753    | Mn <sup>2</sup> | 1 N d?                  | 5442 155    |           | 0000                    |
| 5432 951    |                 | 0000                    | 5442 499    | A?        | 0000                    |
| 5433 160    | Fe              | 2                       | 5442 628    | Cr        | 00                      |
| 5433 406    |                 | 000 N d?                | 5442 971    |           | 0000 N                  |
| 5433 614    |                 | 00 N                    | 5443 179    |           | 000                     |
| 5433 844    |                 | 00 N                    | 5443 405    |           | 0000                    |
| 5434 384    |                 | 0000 N                  | 5443 629    |           | 000                     |
| 5434 740 s  | Fe              | 5                       | 5443 825    |           | 000                     |
| 5435 069    |                 | 0000                    | 5444 108    |           | 0000                    |
| 5435 246    |                 | 000                     | 5444 300    |           | 0000                    |
| 5435 388    |                 | 00                      | 5444 796    | Co        | 00                      |
| 5435 790    |                 | 0000                    | 5444 933    |           | 0000                    |
| 5435 906    |                 | 0000                    | 5445 080    |           | 0000                    |
| 5436 071    | Ni              | 2                       | 5445 259    | Fe        | 4                       |
| 5436 265    |                 | 0000                    | 5445 621    |           | 0000                    |
| 5436 341    |                 | 0000                    | 5445 710    |           | 0000                    |
| 5436 508    | Fe              | 1                       | 5446 436    |           | 0000                    |
| 5436 650    |                 | 0000                    | 5446 577    |           | 0000                    |
| 5436 802    | Fe              | 1                       | 5446 797    | Ti        | 2                       |
| 5436 938    |                 | 000                     | 5447 130 s  | Fe        | 6 d?                    |
| 5437 300    | Ni?             | 000                     | 5447 454    |           | 0000                    |
| 5437 413    |                 | 00                      | 5447 737    |           | 000                     |
| 5437 591    |                 | 0000                    | 5447 889    |           | 0000                    |
| 5437 766    |                 | 0000                    | 5448 142    |           | 0000                    |
| 5437 996    |                 | 0000                    | 5448 304    | A?        | 0000                    |
| 5438 259    |                 | 000                     | 5448 582    |           | 00                      |

<sup>1</sup>Compound lines in both Mn and Sun

<sup>2</sup>A means "atmospheric line"



| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 5448 882    |           | 0000                    | 5462 988    |           | 0000                    |
| 5449 138    |           | 000                     | 5463 174 s  | Fe        | 3                       |
| 5449 369    |           | 000                     | 5463 318    |           | 0000                    |
| 5449 913    |           | 0000                    | 5463 494 s  | Fe        | 3                       |
| 5451 005    | Si        | 00                      | 5463 686    |           | 0000                    |
| 5451 132    |           | 0000                    | 5463 841    |           | 0000                    |
| 5451 330    |           | 000                     | 5464 037    |           | 0000                    |
| 5452 160    |           | 0000                    | 5464 179    | Cr        | 000                     |
| 5452 309    |           | 00                      | 5464 314    |           | 0000 N                  |
| 5452 504    |           | 000                     | 5464 490    | Fe        | 0                       |
| 5452 817    |           | 0000                    | 5464 678    |           | 0000 N                  |
| 5453 056    |           | 00 N                    | 5465 351    | A?        | 000 N                   |
| 5453 293    |           | 0000                    | 5465 584    |           | 0000                    |
| 5453 444    |           | 00                      | 5466 237    |           | 0000 N                  |
| 5453 860    |           | 000                     | 5466 409    |           | 0000                    |
| 5454 064    |           | 000                     | 5466 609 s  | Fe        | 3                       |
| 5454 199    |           | 00                      | 5466 793    |           | 0000                    |
| 5454 326    |           | 000                     | 5466 970    |           | 0000                    |
| 5454 569    |           | 0000                    | 5467 198    | Fe        | 1                       |
| 5454 783    | Co        | 00                      | 5467 355    |           | 0000                    |
| 5454 998    |           | 0000                    | 5467 482    |           | 0000                    |
| 5455 297    |           | 0000                    | 5467 605    |           | 000                     |
| 5455 671 s  | Fe?       | 2                       | 5467 773    |           | 0000                    |
| 5455 834 s  | Fe        | 4                       | 5467 989    |           | 000                     |
| 5456 117    |           | 0000 N                  | 5468 149    |           | 0000                    |
| 5456 319    |           | 0000 N                  | 5468 320    |           | 00                      |
| 5456 571    | A?        | 000                     | 5468 601    |           | 000 Nd?                 |
| 5456 734    |           | 000 N                   | 5468 843    |           | 000                     |
| 5457 088    |           | 0000                    | 5469 000    |           | 0000                    |
| 5457 311    |           | 000                     | 5469 278    |           | 0000                    |
| 5457 453    |           | 0000                    | 5469 485    |           | 00 N                    |
| 5457 640    | Mn        | { 000                   | 5469 972    |           | 0000                    |
| 5457 701    |           | { 000                   | 5470 298    |           | 00                      |
| 5458 034    |           | 0000 N                  | 5470 432    | A?        | 0000                    |
| 5459 072    |           | 0000                    | 5470 650    |           | 000                     |
| 5459 406    | A?        | 000                     | 5470 802    | Mn        | { 0                     |
| 5459 593    |           | 0000                    | 5470 883    |           | { 0                     |
| 5460 266    |           | 0000 N                  | 5471 055    |           | 0000                    |
| 5460 572    |           | 000                     | 5471 414    | Ti        | 000                     |
| 5460 721    |           | 00                      | 5471 601    |           | 0000                    |
| 5460 904    |           | 0000 Nd?                | 5472 128    |           | 0000 N                  |
| 5461 088    |           | 00                      | 5472 503    |           | 000                     |
| 5461 349    |           | 0000 N                  | 5472 685    |           | 0000 Nd?                |
| 5461 602    |           | 0000 N                  | 5472 916    | Fe        | 1                       |
| 5461 762    |           | 0                       | 5473 135    |           | 0000                    |
| 5462 027    |           | 000 N                   | 5473 211    |           | 0000                    |
| 5462 269    | A?        | 0000 N                  | 5473 373    |           | 00                      |
| 5462 478    |           | 0000                    | 5473 594    |           | 000                     |
| 5462 705 s  | Ni        | 1                       | 5473 758    |           | 000 N                   |
| 5462 866    |           | 0000                    | 5473 950    |           | 0000                    |

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 5474 113    | Fe        | 3                       | 5484 517    |           | 0000                    |
| 5474 299    |           | 0000                    | 5484 846    |           | 000                     |
| 5474 436    | Ti?       | 00                      | 5485 023    |           | 0000                    |
| 5474 668    |           | 000                     | 5485 266    |           | 0000                    |
| 5474 962    |           | 0000 N                  | 5485 580    |           | 0000                    |
| 5475 286    |           | 0000 N                  | 5485 757    |           | 000                     |
| 5475 645    |           | 000 N                   | 5485 915    |           | 0000                    |
| 5475 938    |           | 0000 N                  | 5486 016    |           | 000                     |
| 5476 217    |           | 0000 N                  | 5486 320    |           | 000                     |
| 5476 387    |           | 00                      | 5486 730    |           | 000                     |
| 5476 500    | Fe        | 1                       | 5486 968    |           | 000                     |
| 5476 778    | Fe        | 3                       | 5487 170    |           | 000 N                   |
| 5476 946    |           | 0000                    | 5487 354    | Fe        | 1                       |
| 5477 123 s  | Ni        | 5                       | 5487 534    | V         | 0000 N                  |
| 5477 290    |           | 0000                    | 5487 724    | Li        | 00 N                    |
| 5477 486    |           | 0000                    | 5487 959 s  | Fe        | 3                       |
| 5477 707    |           | 000 N d                 | 5488 139    |           | 000                     |
| 5477 901    | Ti        | 00                      | 5488 374    |           | 00 Nd?                  |
| 5477 992    |           | 000                     | 5488 547    |           | 0000                    |
| 5478 160    |           | 0000                    | 5488 717    |           | 0000                    |
| 5478 360    | A?        | 0000                    | 5489 194    |           | 00                      |
| 5478 578    |           | 00                      | 5489 893    |           | 000                     |
| 5478 668    | Fe        | 0                       | 5490 074    |           | 00                      |
| 5478 900    |           | 0000                    | 5490 207    |           | 0000                    |
| 5478 991    |           | 000                     | 5490 367    | Li        | 0                       |
| 5479 234    |           | 0000                    | 5490 531    |           | 0000                    |
| 5479 451    |           | 0000 N                  | 5490 672    |           | 0000                    |
| 5479 983    |           | 0000                    | 5490 905    |           | 0                       |
| 5480 185    |           | 000                     | 5491 037    |           | 000                     |
| 5480 408    |           | 0000                    | 5491 897    |           | 0000                    |
| 5480 562    |           | 0000                    | 5492 049    |           | 00                      |
| 5480 722    | Cr        | 00 N                    | 5492 242    |           | 0000                    |
| 5480 964    |           | 000                     | 5492 424    |           | 000                     |
| 5481 071    | Fe        | 1                       | 5492 566    |           | 000                     |
| 5481 273    |           | 000 N                   | 5493 095    |           | 00                      |
| 5481 452    | Fe        | 1                       | 5493 274    |           | 0000                    |
| 5481 652    | Fe, Li    | 1                       | 5493 450    |           | 00                      |
| 5481 815    |           | 0000                    | 5493 558    |           | 0000                    |
| 5481 941    |           | 0000                    | 5493 709    | Fe        | 1                       |
| 5482 078    |           | 00                      | 5493 865    |           | 0000                    |
| 5482 200    |           | 0000                    | 5494 063    |           | 0 d                     |
| 5482 469    |           | 000 N                   | 5494 193    |           | 0000                    |
| 5482 807    |           | 000 N                   | 5494 358    |           | 0000                    |
| 5483 131    |           | 0000                    | 5494 536    |           | 0000                    |
| 5483 307    | Fe        | 1                       | 5494 679    | Fe        | 0                       |
| 5483 566    | Co        | 1 d?                    | 5494 912    |           | 000                     |
| 5483 758    |           | 0000                    | 5495 096    | Ni        | 00                      |
| 5483 884    |           | 000                     | 5495 916    |           | 000                     |
| 5484 112    |           | 000                     | 5496 119    |           | 0000                    |
| 5484 244    |           | 000                     | 5496 458    |           | 0000                    |

| Wave length | Substance | Intensity and Character | Wave-length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 5496 780    | Fe        | 00                      | 5507 196    | Y<br>Ni   | 0000                    |
| 5497 011    |           | 000 •                   | 5507 985    |           | 000                     |
| 5497 192    |           | 0000                    | 5508 289    |           | 0000 d?                 |
| 5497 325    |           | 000                     | 5508 451    |           | 0000                    |
| 5497 447    |           | 0000                    | 5508 625    |           | 0                       |
| 5497 624    |           | 0000                    | 5508 840    |           | 0                       |
| 5497 735 s  |           | 5                       | 5509 058    |           | 0000                    |
| 5497 911    |           | 0000                    | 5509 321    |           | 0000                    |
| 5498 105    |           | 000                     | 5509 756    |           | 00                      |
| 5498 394    |           | 0000                    | 5509 938    |           | 000 N                   |
| 5498 566    |           | 0000                    | 5510 120    | Fe        | 0                       |
| 5498 955    |           | 0000                    | 5510 229    |           | 1                       |
| 5499 234    |           | 000                     | 5510 449    |           | 0000                    |
| 5499 376    |           | 0000 •                  | 5510 586    |           | 0000                    |
| 5499 635    |           | 000                     | 5510 829    |           | 00                      |
| 5499 804    |           | 00                      | 5510 942    |           | 00                      |
| 5499 976    |           | 0000                    | 5511 173    |           | 0000                    |
| 5500 560    |           | 0000                    | 5511 375    |           | 0000                    |
| 5500 811    |           | 0000                    | 5511 644    |           | 000                     |
| 5500 957    |           | 0000                    | 5511 872    |           | 0000                    |
| 5501 193    | La        | 000                     | 5512 013 •  | Fe        | 00                      |
| 5501 461    |           | 0000 N d?               | 5512 266    |           | 00                      |
| 5501 683 s  | Fe        | 5                       | 5512 470    | Fe        | 1                       |
| 5501 919    | Fe        | 0000                    | 5512 620    |           | 00                      |
| 5502 088    |           | 0000                    | 5512 741    | Ti        | 2                       |
| 5502 297    |           | 00                      | 5512 923    |           | 0000                    |
| 5502 480    |           | 0000                    | 5513 025    | Ca        | 0000                    |
| 5502 783    |           | 0000                    | 5513 198 s  |           | 4                       |
| 5502 955    |           | 0000                    | 5513 439    | Ti        | 0000                    |
| 5503 153    |           | 00                      | 5513 592    |           | 0000                    |
| 5503 286    |           | 1                       | 5513 769    |           | 0000                    |
| 5503 444    |           | 00                      | 5513 926    |           | 0000                    |
| 5503 710    |           | 00 N                    | 5514 057    |           | 0000                    |
| 5503 927    |           | 000 N                   | 5514 189    |           | 0000                    |
| 5504 117    | Ti        | 0                       | 5514 431    |           | 0000                    |
| 5504 310    |           | 00                      | 5514 563    | Ti        | 2                       |
| 5504 431    | Mn        | 0000                    | 5514 753    |           | 2                       |
| 5504 599    |           | 00                      | 5514 902    | Mn        | 0000                    |
| 5504 867    |           | 0000                    | 5515 006    |           | 000                     |
| 5505 099    |           | 0000                    | 5515 150    |           | 0000                    |
| 5505 489    |           | 0000                    | 5515 317    |           | 0000                    |
| 5505 747    |           | 0000 N                  | 5515 565    |           | 000                     |
| 5505 939    |           | 0000                    | 5515 697    |           | 0000                    |
| 5506 095    |           | 1                       | 5515 857    |           | 00                      |
| 5506 243 •  |           | 0000                    | 5516 051    |           | 0000                    |
| 5506 395    |           | 000                     | 5516 253    |           | 0000 N                  |
| 5506 576    |           | 000                     | 5516 513    |           | 000                     |
| 5506 719    | Fe        | 000                     | 5516 708    |           | 000                     |
| 5506 823    |           | 0000                    | 5516 950    |           | 0                       |
| 5507 000 s  |           | 5                       | 5517 034    |           | 0                       |

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 5517 286    | Fe        | 0                       | 5527 796    | Mg        | 000 d                   |
| 5517 458    |           | 0000                    | 5528 084    |           | 0000 N                  |
| 5517 589    |           | 0000                    | 5528 297    |           | 000                     |
| 5517 756    |           | 00                      | 5528 641 s  |           | 8                       |
| 5517 984    |           | 0000 N                  | 5529 115    |           | 00                      |
| 5518 307    |           | 000                     | 5529 384    |           | 00                      |
| 5518 378    |           | 0000                    | 5529 564    |           | 000                     |
| 5518 576    |           | 0000                    | 5530 001    |           | 0000                    |
| 5518 754    |           | 0000                    | 5530 178    |           | 000 d                   |
| 5519 001    |           | 0000                    | 5530 491    |           | 0000                    |
| 5519 289    |           | 0000                    | 5530 704    |           | 00 N                    |
| 5519 633    |           | 000                     | 5530 997    |           | 00 N                    |
| 5519 797    |           | 0                       | 5531 321    |           | 0000                    |
| 5520 069    |           | 000 N                   | 5531 913    |           | 0000                    |
| 5520 246    |           | 0000                    | 5532 202    |           | 00                      |
| 5520 434    |           | 000 N                   | 5532 353    |           | 000                     |
| 5520 727    |           | 00 N                    | 5532 571    |           | 000 N                   |
| 5520 920    |           | 0000                    | 5532 968    |           | 1                       |
| 5521 160    |           | 00 N                    | 5533 092    |           | 0                       |
| 5521 349    |           | 00                      | 5533 248    |           | 000                     |
| 5521 511    |           | 00                      | 5533 365    |           | 0000                    |
| 5521 646    |           | 000                     | 5533 651    |           | 000                     |
| 5521 799    |           | 00                      | 5533 791    |           | 000                     |
| 5522 002    | Fe        | 0000 N                  | 5534 011    | Fe        | 000 d                   |
| 5522 407    |           | 0000 N                  | 5534 504    |           | 000                     |
| 5522 665    |           | 2                       | 5534 620    |           | 0000                    |
| 5522 883    |           | 0000 N                  | 5534 895    |           | 000                     |
| 5523 176    |           | 0000 N                  | 5535 061 s  |           | 2                       |
| 5523 469    |           | 000                     | 5535 277    |           | 0000 N                  |
| 5523 550    |           | 000                     | 5535 399    |           | 000 N                   |
| 5523 783    |           | 000 N                   | 5535 644    |           | 2                       |
| 5523 960    |           | 0000                    | 5535 778    |           | 0                       |
| 5524 077    |           | 0000                    | 5535 985    |           | 0000                    |
| 5524 209    |           | 00                      | 5536 072    |           | 0000                    |
| 5524 482    |           | 000                     | 5536 300    |           | 000                     |
| 5524 684    |           | 000                     | 5536 492    |           | 000                     |
| 5524 785    |           | 0000                    | 5536 679    |           | 0000                    |
| 5525 010    |           | 000                     | 5536 811    |           | 00                      |
| 5525 220    |           | 000                     | 5537 031    |           | 0000                    |
| 5525 347    |           | 00                      | 5537 139    |           | 0000                    |
| 5525 565    |           | 0000 N                  | 5537 332    |           | 000                     |
| 5525 765    | Fe        | 2                       | 5537 509    |           | 0000                    |
| 5525 929    |           | 000                     | 5537 726    |           | 0000 Nd?                |
| 5526 066    |           | 000 N                   | 5537 928    | Mn        | 00                      |
| 5526 405    |           | 000 N                   | 5538 025    |           | 00                      |
| 5526 789    |           | 000 N                   | 5538 253    |           | 0000                    |
| 5527 033    |           | 3                       | 5538 405    |           | 0000                    |
| 5527 208    |           | 000                     | 5538 526    |           | 0000                    |
| 5527 325    |           | 0000                    | 5538 738    |           | 0000                    |
| 5527 619    |           | 0000                    | 5538 925    |           | 1                       |
|             |           |                         |             |           | 0000                    |

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 5539 273    | Fe        | 0000                    | 5551 995    | Mn        | 0000 N                  |
| 5539 507    |           | 0                       | 5552 193    |           | 000                     |
| 5539 745    |           | 0000 Nd?                | 5552 452    |           | 000                     |
| 5540 044    |           | 000                     | 5552 673    |           | 0000Nd?                 |
| 5540 192    |           | 0000                    | 5552 916    |           | 00                      |
| 5540 393    |           | 000 N                   | 5553 068    |           | 0000                    |
| 5540 661    |           | 000 N                   | 5553 346    |           | 000 N                   |
| 5540 940    |           | 000                     | 5553 452    |           | 000 N                   |
| 5541 110    |           | 000                     | 5553 619    |           | 0000 N                  |
| 5541 501    |           | 0000                    | 5553 804    | Fe        | 1                       |
| 5541 805    |           | 0000                    | 5553 927    |           | 0                       |
| 5542 361    |           | 0000                    | 5554 161    |           | 0000                    |
| 5542 545    |           | 0000                    | 5554 459    |           | 0000 N                  |
| 5542 756    |           | 0000                    | 5554 748    | Fe        | 0000                    |
| 5542 969    |           | 0000                    | 5554 879    |           | 0000                    |
| 5543 112    |           | 0000                    | 5555 036    |           | 00                      |
| 5543 262    |           | 000                     | 5555 122 s  |           | 3                       |
| 5543 414 s  | Fe        | 2                       | 5555 395    |           | 0000                    |
| 5543 626    |           | 0000                    | 5555 572    |           | 0000                    |
| 5543 975    |           | 0000                    | 5555 683    |           | 0000                    |
| 5544 157 s  | Fe        | 2                       | 5555 860    |           | 000                     |
| 5544 386    |           | 000                     | 5555 951    |           | 0000                    |
| 5544 560    | Y         | 0000                    | 5556 418    |           | 0000 N                  |
| 5544 831    |           | 000                     | 5556 691    |           | 0000                    |
| 5544 983    |           | 0000                    | 5556 933    |           | 0000 N                  |
| 5545 266    | Fe, V     | 0000                    | 5557 196    | Fe        | 000                     |
| 5545 487    |           | 0000                    | 5557 287    |           | 000                     |
| 5545 643    |           | 0000                    | 5557 710    |           | 000                     |
| 5545 913    |           | 0000 Nd?                | 5557 946    |           | 000 N                   |
| 5546 147    |           | 000 } d                 | 5558 136    |           | 0                       |
| 5546 248    |           | 000 }                   | 5558 209    |           | 0                       |
| 5546 562    |           | 0000                    | 5558 391    |           | 0000                    |
| 5546 732    |           | 2                       | 5558 472    |           | 0000                    |
| 5546 956    |           | 000                     | 5558 816    |           | 0000                    |
| 5547 215    |           | 1                       | 5559 068    |           | 000 Nd?                 |
| 5547 522    |           | 0000 Nd?                | 5559 281    |           | 000 Nd?                 |
| 5547 910    |           | 0000 N                  | 5559 867    | Fe        | 00                      |
| 5548 161    |           | 0000                    | 5560 106    |           | 000                     |
| 5548 413    |           | 0000                    | 5560 243    |           | 0000                    |
| 5548 535    |           | 0000                    | 5560 434    |           | 2                       |
| 5548 697    |           | 0000                    | 5560 647    |           | 0000                    |
| 5549 546    |           | 0000                    | 5560 911    |           | 0000                    |
| 5549 748    |           | 0000                    | 5561 234    |           | 0000                    |
| 5549 875    |           | 00                      | 5561 464    |           | 00                      |
| 5550 179    |           | 00                      | 5561 699    |           | 0000 N                  |
| 5550 873    |           | 0000                    | 5561 821    |           | 0000 N                  |
| 5551 110    |           | 0000                    | 5562 044    |           | 0000 N                  |
| 5551 241    |           | 0000                    | 5562 343    |           | 000                     |
| 5551 524    |           | 0000 N                  | 5562 500    |           | 0000                    |
| 5551 767    |           | 000 N                   | 5562 717    |           | 0000                    |

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 5562 933    | Fe        | 2                       | 5575 310    |           | 0000                    |
| 5563 144    |           | 0000 N                  | 5575 614    |           | 0000                    |
| 5563 506    |           | 000 N                   | 5575 766    |           | 0000                    |
| 5563 623    |           | 0000                    | 5575 897    |           | 0000                    |
| 5563 824    | Fe        | 3                       | 5576 079    |           | 0000                    |
| 5563 916    |           | 0                       | 5576 320 s  | Fe        | 4                       |
| 5564 352    |           | 0000 N                  | 5576 589    |           | 0000                    |
| 5565 191    |           | 0000                    | 5577 252    |           | 00                      |
| 5565 700    | Ti        | 00                      | 5577 561    |           | 000                     |
| 5565 931    | Fe        | 3                       | 5577 783    |           | 0000                    |
| 5566 172    |           | 0000 N                  | 5578 739    |           | 0000                    |
| 5566 304    |           | 00                      | 5578 946    | Ni        | 1                       |
| 5566 456    |           | 0000                    | 5579 260    |           | 0000                    |
| 5566 629    |           | 0000                    | 5579 381    |           | 0000                    |
| 5566 780    |           | 0000                    | 5579 574    |           | 000                     |
| 5566 947    |           | 000                     | 5579 711    |           | 0000                    |
| 5567 035    |           | 000                     | 5580 530    |           | 0000                    |
| 5567 205    |           | 0000 N                  | 5580 672    |           | 000                     |
| 5567 367    |           | 0000 N                  | 5580 879    |           | 0000                    |
| 5567 501    |           | 000                     | 5581 273    |           | 0000                    |
| 5567 621    | Fe        | 2                       | 5581 502    |           | 0000                    |
| 5567 802    |           | 0000                    | 5581 740    |           | 0000                    |
| 5567 989    |           | 000 Nd?                 | 5581 922    |           | 0000 N                  |
| 5568 297    |           | 000                     | 5582 198 s  | Ca        | 4                       |
| 5568 490    |           | 0000                    | 5582 367    |           | 0000                    |
| 5568 682    |           | 0000                    | 5582 506    |           | 000                     |
| 5568 925    |           | 0000                    | 5582 630    |           | 0000                    |
| 5569 088    |           | 00                      | 5582 973    |           | 0000                    |
| 5569 249    |           | 0000                    | 5583 186    |           | 000                     |
| 5569 370    |           | 000                     | 5583 358    |           | 0000                    |
| 5569 542    |           | 0000                    | 5583 607    |           | 0000 N                  |
| 5569 848 s  | Fe        | 6                       | 5583 845    |           | 000 N                   |
| 5570 286    |           | 000                     | 5584 208    |           | 00 N                    |
| 5570 615    |           | 000                     | 5584 532    |           | 000                     |
| 5570 827    |           | 000                     | 5584 729    |           | 000                     |
| 5570 982    |           | 0000                    | 5584 988    | Fe        | 0                       |
| 5571 708    |           | 0000                    | 5585 260    |           | 0000                    |
| 5572 370    |           | 000 N                   | 5585 397    |           | 000                     |
| 5572 572    |           | 0000 }                  | 5585 543    |           | 0000                    |
| 5572 669    |           | 0000 }                  | 5585 726    |           | 0000                    |
| 5572 871    |           | 000                     | 5585 877    |           | 000                     |
| 5573 075    | Fe        | 6                       | 5586 222    |           | 0000                    |
| 5573 328    |           | 1                       | 5586 497    |           | 000                     |
| 5573 524    |           | 0000                    | 5586 900    |           | 000 N                   |
| 5573 762    |           | 0000                    | 5586 991    | Fe        | 7                       |
| 5573 876    |           | 000                     | 5587 355    |           | 0000                    |
| 5573 974    |           | 000                     | 5587 588    |           | 0000 Nd?                |
| 5574 616    |           | 000                     | 5587 800    | Fe        | 0                       |
| 5574 834    |           | 0000                    | 5587 947    |           | 0000                    |
| 5575 128    |           | 000                     | 5588 084    | Ni        | 1                       |

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 5588 368    |           | 000                     | 5602 995    | Fe        | 1                       |
| 5588 469    |           | 0000                    | 5603 083    | Ca        | 3                       |
| 5588 985 s  | Ca        | 6                       | 5603 186    | Fe        | 4                       |
| 5589 227    |           | 000                     | 5603 516    |           | 0000                    |
| 5589 429    |           | 0000 N                  | 5603 738    |           | 0000                    |
| 5589 582    | Ni        | 0                       | 5603 993    |           | 00                      |
| 5586 794    |           | 0000 Nd?                | 5604 416    |           | 0000                    |
| 5590 079    |           | 00                      | 5605 171    |           | 000                     |
| 5590 343 s  | Ca        | 3                       | 5605 560    |           | 0000                    |
| 5590 589    |           | 000                     | 5605 864    |           | 000                     |
| 5590 725    |           | 0000                    | 5606 122    |           | 000                     |
| 5590 927    | Ti        | 000                     | 5606 268    |           | 0000                    |
| 5591 039    | Ti        | 000                     | 5607 220    |           | 000                     |
| 5591 226    |           | 0000                    | 5607 372    |           | 0000                    |
| 5591 586    |           | 000                     | 5607 614    |           | 000                     |
| 5592 192    |           | 0000                    | 5607 761    |           | 0000                    |
| 5592 375    | Ni        | 0                       | 5607 887    |           | 00                      |
| 5592 487    | Fe, Ni    | 1                       | 5608 059    |           | 0000                    |
| 5592 643    |           | 000                     | 5608 393    |           | 000                     |
| 5592 881    |           | 000                     | 5608 525    |           | 000                     |
| 5593 458    |           | 0000                    | 5608 930    |           | 0000 N                  |
| 5593 680    |           | 000                     | 5609 196    |           | 00                      |
| 5593 961    | Ni        | 0                       | 5609 395    |           | 0000                    |
| 5594 196    |           | 0000 N                  | 5609 901    |           | 0000                    |
| 5594 383    |           | 0000 N                  | 5610 023    |           | 000                     |
| 5594 691 s  | Ca        | 4                       | 5610 205    |           | 000                     |
| 5594 884    | Fe        | 1                       | 5610 467    |           | 000                     |
| 5595 112    |           | 0000 N                  | 5610 609    |           | 0000                    |
| 5595 284    |           | 000                     | 5611 584    |           | 00                      |
| 5595 704    |           | 0000                    | 5611 855    |           | 000                     |
| 5595 906    |           | 0000                    | 5612 573    |           | 000                     |
| 5596 129    |           | 0000                    | 5612 710    |           | 000                     |
| 5596 402    |           | 000                     | 5613 929    |           | 000 N                   |
| 5596 555    |           | 0000                    | 5614 253    |           | 0000 N                  |
| 5597 290    |           | 000                     | 5614 497    |           | 00 N                    |
| 5597 465    |           | 0000                    | 5614 632    |           | 0000                    |
| 5598 524 s  | Fe        | 1                       | 5614 819    |           | 0000                    |
| 5598 711 s  | Ca        | 4                       | 5614 997    | Ni        | 0                       |
| 5599 034    |           | 000                     | 5615 199    |           | 0000                    |
| 5599 170    |           | 0000                    | 5615 382    |           | 0000                    |
| 5600 243    |           | 00 } d                  | 5615 520 s  | Fe        | 2                       |
| 5600 318    |           | 0000 }                  | 5615 751    |           | 0                       |
| 5600 450    | Fe        | 0                       | 5615 877 s  | Fe        | 6                       |
| 5600 678    |           | 0000                    | 5616 404    |           | 000                     |
| 5601 037    |           | 0000                    | 5616 541    |           | 0000                    |
| 5601 505 s  | Ca        | 3                       | 5617 163    |           | 0000                    |
| 5601 654    |           | 0000                    | 5617 365    |           | 00                      |
| 5602 042    |           | 00 Nd?                  | 5617 451    |           | 00                      |
| 5602 296    |           | 000                     | 5617 633    |           | 0000                    |
| 5602 783    |           | 000                     | 5617 765    |           | 0000                    |

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 5617 972    | Fe        | 0000                    | 5630 091    | Fe        | 0000                    |
| 5618 130    |           | 000                     | 5630 313    |           | 000                     |
| 5618 292    |           | 0000 N                  | 5630 516    |           | 0000                    |
| 5618 646    |           | 000 N                   | 5631 194    |           | 0000 N                  |
| 5618 858    |           | 1                       | 5631 376    |           | 0000                    |
| 5619 060    |           | 000 N                   | 5631 720    |           | 0000                    |
| 5619 192    |           | 0000 N                  | 5631 913    |           | 000 N                   |
| 5619 455    |           | 000                     | 5632 049    |           | 000 N                   |
| 5619 637    |           | 0000                    | 5632 232    |           | 000                     |
| 5619 824    |           | 0                       | 5632 672    |           | 000 Nd?                 |
| 5620 037    |           | 000                     | 5632 971    |           | 0000                    |
| 5620 250    |           | 000                     | 5633 441    |           | 000 Nd?                 |
| 5620 452    |           | 0000 Nd?                | 5633 659    |           | 0000 N                  |
| 5620 634    |           | 000                     | 5633 866    |           | 0000                    |
| 5620 715    |           | 0                       | 5633 967    |           | 0000                    |
| 5620 862    | Fe        | 0000                    | 5634 171 s  |           | 3                       |
| 5621 438    |           | 000 N                   | 5634 446    | C         | 0000 Nd?                |
| 5621 595    |           | 000 N                   | 5634 740    |           | 0000                    |
| 5621 833    |           | 000                     | 5635 412    |           | 0000                    |
| 5622 450    | Fe        | 000                     | 5635 559    | C         | 0000                    |
| 5622 996    |           | 000                     | 5635 736    |           | 0000                    |
| 5623 179    |           | 00                      | 5636 045    |           | 1                       |
| 5623 857    |           | 0000                    | 5636 218    |           | 0000                    |
| 5624 245 s  |           | 1                       | 5636 339    | Fe        | 0000                    |
| 5624 408    |           | 0000 N                  | 5636 455    |           | 000                     |
| 5624 575    |           | 0000 N                  | 5636 688    |           | 000 N                   |
| 5624 769 s  | Fe, V     | 4                       | 5636 925    |           | 0                       |
| 5625 096    |           | 000                     | 5637 113    | Fe?, Ni   | 0000 Nd?                |
| 5625 304    | Ni        | 0000 Nd?                | 5637 339    |           | 1                       |
| 5625 541    |           | 0                       | 5637 632    | Fe        | 1                       |
| 5625 755    | V         | 000                     | 5637 928    |           | 000 N                   |
| 5625 904    |           | 00                      | 5638 488    | Fe        | 3                       |
| 5627 245    |           | 000 N                   | 5638 707    |           | 0000                    |
| 5626 468    |           | 0000                    | 5638 980    |           | 00                      |
| 5626 812    |           | 0000                    | 5639 575    |           | 000                     |
| 5627 034    |           | 000                     | 5639 775    |           | 0000                    |
| 5627 313    |           | 000                     | 5640 215    |           | 0000                    |
| 5627 475    |           | 0000                    | 5640 397    |           | 0000                    |
| 5627 592    |           | 0000                    | 5640 538    |           | 0                       |
| 5627 723    |           | 000                     | 5640 721    |           | 0000                    |
| 5627 859    |           | 00                      | 5640 903    |           | 0000                    |
| 5628 087    | Ni        | 0000                    | 5641 206    | Fe        | 1                       |
| 5628 239    |           | 000 N                   | 5641 353    |           | 000                     |
| 5628 411    |           | 0000                    | 5641 510    |           | 0000                    |
| 5628 571    |           | 00                      | 5641 667 s  |           | 2                       |
| 5628 867    |           | 00                      | 5641 954    |           | 0000 d                  |
| 5629 099    | Cr        | 0000                    | 5642 112    |           | 0                       |
| 5629 261    |           | 000                     | 5642 396    | Ni        | 0000                    |
| 5629 453    |           | 0000                    | 5642 605    |           | 00                      |
| 5629 924    |           | 0000                    | 5642 846    |           | 000                     |



| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 5642 978    |           | 00                      | 5657 471    |           | 0000                    |
| 5643 302    | Ni        | 0                       | 5657 667    |           | 000                     |
| 5643 503    |           | 0000 N                  | 5657 890    |           | 0000                    |
| 5643 817    |           | 0000 N                  | 5658 097 s  | Y,-       | 2                       |
| 5644 159    |           | 000                     | 5658 378    |           | 0000                    |
| 5644 257    | Ti        | 00                      | 5658 561    |           | 0                       |
| 5644 365    |           | 0                       | 5658 753    | Fe        | 1                       |
| 5644 566    |           | 000                     | 5658 884    | Cr        | 0                       |
| 5645 254    |           | 000 N                   | 5659 052    | Fe        | 4                       |
| 5645 830 s  | Si        | 1                       | 5659 326    |           | 0000                    |
| 5646 039    |           | 00                      | 5659 545    |           | 0000                    |
| 5646 322    |           | 000 N                   | 5659 817    |           | 0                       |
| 5646 530    |           | 0000 N                  | 5660 001    |           | 0000                    |
| 5646 904    |           | 00                      | 5660 133    |           | 0000                    |
| 5647 461    | Ti        | 00                      | 5660 365    |           | 0000                    |
| 5647 664    |           | 0000                    | 5660 527    |           | 0000                    |
| 5647 765    |           | 0000                    | 5660 739    |           | 00                      |
| 5647 997    |           | 0000                    | 5660 892    |           | 0                       |
| 5648 119    |           | 0000                    | 5661 022    |           | 0                       |
| 5648 503    |           | 000                     | 5661 240    |           | 000                     |
| 5648 796    | Ti        | 00                      | 5661 418    |           | 0000                    |
| 5648 969    |           | 0000                    | 5661 570    | Fe?       | 0                       |
| 5649 131    |           | 0000                    | 5661 712    |           | 0000                    |
| 5649 304    |           | 00                      | 5661 833    |           | 0000                    |
| 5649 611    | Cr        | 00 N                    | 5662 025    |           | 0000                    |
| 5649 898    | Fe-Ni     | 0 d                     | 5662 200    |           | 0000                    |
| 5650 209    | Fe        | 1                       | 5662 374    | Ti        | 0                       |
| 5650 420    |           | 0000                    | 5662 526    |           | 0000                    |
| 5650 501    |           | 0000                    | 5662 744 s  | Fe        | 4                       |
| 5650 669    |           | 0000                    | 5662 967    |           | 0000 N                  |
| 5650 911    | Fe        | 1                       | 5663 155    | Ti, Fe, Y | 1                       |
| 5651 099    |           | 0000                    | 5663 341    |           | 0000                    |
| 5651 256    |           | 0000                    | 5663 735    |           | 0000                    |
| 5651 489    |           | 0000                    | 5664 039    |           | 0000                    |
| 5651 691    | Fe        | 0                       | 5664 218    | Ni-Cr     | 1 N                     |
| 5651 954    |           | 0000 N d?               | 5664 413    |           | 0000                    |
| 5652 239    |           | 0000                    | 5664 575    |           | 0000                    |
| 5652 542    | Fe        | 1                       | 5664 797    |           | 000                     |
| 5653 387    |           | 0000                    | 5665 557    |           | 0000                    |
| 5653 898    |           | 0000                    | 5665 775    | Si        | 1 N                     |
| 5654 091    | Fe        | 1                       | 5666 131    | A?        | 000                     |
| 5654 231    |           | 0000                    | 5666 899    |           | 0                       |
| 5654 716    |           | 00                      | 5666 998    |           | 000                     |
| 5654 991    |           | 0000 N                  | 5667 368    |           | 0                       |
| 5655 156    |           | 00 N                    | 5667 542    |           | 000                     |
| 5655 395    | Fe        | 1                       | 5667 739    | Fe        | 2                       |
| 5655 558    |           | 0000                    | 5667 997    |           | 0000                    |
| 5655 715 s  | Fe        | 2                       | 5668 300    |           | 0000                    |
| 5655 908    |           | 0000                    | 5668 593    | V         | 000                     |
| 5657 107    |           | 0000                    | 5669 130    |           | 0000                    |

# PRELIMINARY TABLE OF SOLAR SPECTRUM WAVE-LENGTHS X

By HENRY A. ROWLAND

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 5669 258    |           | I                       | 5680 470    |           | 00                      |
| 5669 464    |           | 0000 N d?               | 5680 769    | A?        | 0000                    |
| 5669 962    |           | 0                       | 5680 978    | A         | 000                     |
| 5670 163    | Ni        | 0                       | 5681 292    |           | 000                     |
| 5670 304    |           | 0000                    | 5681 462    |           | 000                     |
| 5670 569    | A         | 000                     | 5681 747    |           | 0000                    |
| 5671 071    | V         | 0                       | 5681 965    | A         | 00                      |
| 5671 285    |           | 0000 N                  | 5682 031    | A?        | 0000                    |
| 5671 712    |           | 00 N                    | 5682 427    |           | 2                       |
| 5672 047    | Sc        | 0                       | 5682 718    |           | 000                     |
| 5672 485    |           | 0000 N                  | 5682 869 s  | Na        | 5                       |
| 5673 022    |           | 0000                    | 5683 230    |           | 000 N                   |
| 5673 272    |           | 0000                    | 5683 696    | , A?      | 000                     |
| 5673 634    |           | 000 N                   | 5683 989    | A         | 000                     |
| 5674 198    | A         | 0000                    | 5684 098    | A         | 0                       |
| 5674 387    |           | 0000                    | 5684 118    |           | 0000                    |
| 5674 496    | A         | 0000                    | 5684 415    |           | 1                       |
| 5674 835    |           | 0000 N                  | 5684 710    | Si        | 3                       |
| 5675 305    |           | 0000 N                  | 5684 950    |           | 0000 N                  |
| 5675 647 s  | Ti        | 2 N                     | 5685 250    | A?        | 0000                    |
| 5675 946    |           | 000 N d?                | 5685 657    | -, A      | 00 d                    |
| 5676 568    |           | 0000                    | 5685 996    | A?        | 000                     |
| 5677 007    | A         | 000                     | 5686 100    |           | 000                     |
| 5677 175    |           | 0000                    | 5686 371    |           | 0000                    |
| 5677 680    |           | 0000                    | 5686 429    |           | 0                       |
| 5677 919    |           | 00                      | 5686 580    |           | 000                     |
| 5678 277    |           | 0000                    | 5686 757    | Fe        | 3                       |
| 5678 621    |           | 000                     | 5687 063    |           | 000                     |
| 5678 830    |           | 000                     | 5687 192    |           | 0000                    |
| 5679 025    | -, A?     | 0000 N                  | 5687 697    | -, A      | 0                       |
| 5679 249 s  | Fe        | 3                       | 5687 834    | A?        | 000                     |
| 5679 501    |           | 0000 N                  | 5688 436 s  | Na        | 6                       |
| 5679 821    | A         | 0000 N                  | 5688 759    |           | 0000                    |
| 5680 149    |           | 000                     | 5688 810    | A         | 00                      |

What is known as the "low sun band" begins at  $\lambda$  5670 and extends nearly to the "rain-band" at  $\lambda$  5860. Its existence is supposed to be due mostly to some dry gas in the Earth's atmosphere. There are, however, probably water-vapor lines scattered through this region, and some of the lines are known to be due to oxygen.

The "rain-band" begins at  $\lambda$  5860 and extends to  $\lambda$  6030.

TABLE OF SOLAR SPECTRUM WAVE-LENGTHS 111

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 5689 255    | A?        | 0000                    | 5702 876    | Ti        | 000                     |
| 5689 694    | Li        | 0                       | 5703 012    | A         | 0000                    |
| 5689 812    | A?        | 0                       | 5703 136    |           | 000                     |
| 5690 117    | A         | 000                     | 5703 308    |           | 0000                    |
| 5690 286    |           | 0000                    | 5703 438    | A         | 000                     |
| 5690 447    | , A       | 000                     | 5703 591    |           | 0000                    |
| 5690 646    | Si        | 3                       | 5703 797    | V         | 1                       |
| 5691 715    | Fe        | 2                       | 5703 915    |           | 000                     |
| 5691 919    |           | 00                      | 5704 427    | A?        | 000                     |
| 5692 641    | A         | 1                       | 5704 608    |           | 0000                    |
| 5692 970    | A?        | { 000                   | 5704 729    | A?        | 0000                    |
| 5693 095    |           | { 000                   | 5704 960    | A         | 0                       |
| 5693 330    |           | 0000                    | 5705 282    | A?        | 0000 N                  |
| 5693 547    |           | 000 N                   | 5705 525    | A?        | 0000                    |
| 5693 865    | Fe        | 3                       | 5705 688    | Fe        | 1                       |
| 5694 379    | A?        | 000                     | 5706 215    | Fe        | 3                       |
| 5694 962    | Cr        | 0                       | 5706 329    |           | 0                       |
| 5695 207    | Ni        | 2                       | 5706 941    |           | 00 N                    |
| 5695 456    | A?        | 0000                    | 5707 204    | V         | 0                       |
| 5696 160    | A         | 00                      | 5707 265    | Fe        | 1                       |
| 5696 320    | La        | 0                       | 5707 462    |           | 000                     |
| 5696 582    | A?        | 000                     | 5707 614    |           | 0000                    |
| 5696 869    |           | 0000 N                  | 5707 927    |           | 000 N                   |
| 5697 040    | A         | 00                      | 5708 135    |           | 0000 N                  |
| 5697 614    | A?        | 0000                    | 5708 317    | Fe        | 1                       |
| 5697 794    | A         | 000                     | 5708 622 s  | Si        | 3 N                     |
| 5698 047    | A?        | 0000 Nd?                | 5708 881    |           | 0000                    |
| 5698 242    | Fe        | 0                       | 5709 130    |           | 000 N                   |
| 5698 400    | A         | 0                       | 5709 328    |           | 0000                    |
| 5698 555    | Fe, Cr    | 1                       | 5709 601 s  | Fe        | 5                       |
| 5698 746    | V         | 1                       | 5709 775 s  | Ni        | 5                       |
| 5698 910    | A         | 000                     | 5710 005    |           | 000                     |
| 5699 106    |           | 0000 N                  | 5710 144    |           | 00                      |
| 5699 530    | A         | 0                       | 5711 016    | A         | 000                     |
| 5699 638    |           | 000                     | 5711 313 s  | Mg        | 6                       |
| 5699 805    | A         | 0000                    | 5711 615    | A         | 000 d                   |
| 5700 402    |           | 00                      | 5711 760    | A         | 000                     |
| 5700 508    | Cu?       | 00                      | 5712 098    | Fe        | 3                       |
| 5700 738    |           | 000                     | 5712 357    | Fe        | 2                       |
| 5700 938    | A         | 0                       | 5712 620    |           | 000                     |
| 5701 131    |           | 0000 Nd?                | 5712 835    | , A?      | 000                     |
| 5701 323    | Si        | 1 N                     | 5712 996    | Cr        | 0                       |
| 5701 544    |           | 0000                    | 5713 436    |           | 0000                    |
| 5701 772 s  | Fe        | 4                       | 5713 670    |           | 000                     |
| 5701 961    |           | 0000                    | 5714 120    |           | 000                     |
| 5702 110    | A         | 000 N                   | 5714 276    | A         | 000                     |
| 5702 228    |           | 0000                    | 5714 380    | Fe        | 0                       |
| 5702 360    |           | 0000                    | 5714 620    |           | 0000                    |
| 5702 543    | Cr        | 0                       | 5714 774    |           | 00                      |
| 5702 754    |           | 0000                    | 5714 959    |           | 000                     |

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 5715 116    | Ni-Ti, Fe | 0000                    | 5727 873    |           | 00                      |
| 5715 308 s  |           | 5                       | 5728 096    |           | 0000 N                  |
| 5715 540    |           | 0000                    | 5728 319    |           | 0000 N                  |
| 5715 689    |           | 000                     | 5728 742    | A         | 00                      |
| 5716 040    |           | 000                     | 5729 096    | A-        | 00 d?                   |
| 5716 441    |           | 0000 N                  | 5729 417    |           | 000                     |
| 5716 671    |           | 00                      | 5729 876    | A         | 0                       |
| 5717 186    |           | 000                     | 5730 030    | A         | 00                      |
| 5717 523    |           | 0000                    | 5730 116    | A?        | 0000                    |
| 5717 723    |           | 00                      | 5731 075    |           | 0 N                     |
| 5717 918    | Fe        | 000                     | 5731 252    |           | 000 N                   |
| 5718 055    |           | 4                       | 5731 437    |           | 00                      |
| 5718 338    |           | 000 N                   | 5731 535    |           | 00                      |
| 5718 510    |           | 000 N                   | 5731 769    |           | 000                     |
| 5719 154    |           | 00                      | 5731 084 s  | Fe        | 4                       |
| 5719 208    |           | 0000                    | 5732 214    |           | 0000                    |
| 5719 536    |           | 0000                    | 5732 335    |           | 0000                    |
| 5719 795    |           | 1                       | 5732 522    |           | 0                       |
| 5719 931    |           | 000                     | 5732 790    | A         | 0000                    |
| 5720 040    |           | 00                      | 5732 948    |           | 000                     |
| 5720 275    | A?        | 0000                    | 5733 097    |           | 000                     |
| 5720 568    |           | 000                     | 5733 306    | A         | 00 Nd?                  |
| 5720 666    |           | 0                       | 5733 550    |           | 0000                    |
| 5720 933    |           | 000                     | 5733 722    |           | 0000                    |
| 5721 115    |           | 0                       | 5733 908    | A         | 000                     |
| 5721 267    |           | 0000                    | 5734 106    |           | 0000                    |
| 5721 930    |           | 00                      | 5734 262    | A?        | 000                     |
| 5722 047    |           | 000                     | 5734 571    |           | 0000 N                  |
| 5722 170    |           | 0                       | 5734 786    |           | 0                       |
| 5722 397    |           | 000                     | 5735 790    | A         | 0                       |
| 5722 721    | A?        | 000 Nd?                 | 5735 923    |           | 00                      |
| 5722 997    |           | 0000 N                  | 5736 241    |           | 0000 Nd                 |
| 5723 590    |           | 000                     | 5736 858    |           | 0000                    |
| 5723 756    |           | 0000                    | 5737 288    |           | 0                       |
| 5723 885    |           | 000                     | 5737 530    | A?        | 000                     |
| 5723 989    |           | 000                     | 5737 688    |           | 0000                    |
| 5724 107    |           | 0                       | 5737 910    | A, Mn     | 1                       |
| 5724 313    |           | 000                     | 5738 453    |           | 0                       |
| 5724 683    |           | 00                      | 5738 693    | A?        | 000                     |
| 5725 224    |           | 0000                    | 5738 767    |           | 000                     |
| 5725 517    | , A?      | 0000                    | 5739 084    |           | 0000 N                  |
| 5725 880    |           | 000                     | 5739 275    | A?        | 000                     |
| 5726 168    |           | 000 Nd?                 | 5739 458    |           | 0000                    |
| 5726 519    |           | 0000                    | 5739 698    |           | 0                       |
| 5726 701    |           | 0000                    | 5739 873    |           | 000                     |
| 5726 918    |           | 000                     | 5740 020    | A?        | 000                     |
| 5727 097    |           | 0                       | 5740 195    |           | 0                       |
| 5727 271    |           | 2 N                     | 5740 369    |           | 0000                    |
| 5727 505    |           | 0000 N                  | 5740 582    | A?        | 0000                    |
| 5727 682    |           | 000 N                   | 5740 825    |           | 0000 N                  |

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 5741 088    | A?        | 000                     | 5754 308    |           | 000                     |
| 5741 432    | A?        | 000                     | 5754 450    | A         | 0                       |
| 5741 715    | A?        | 000 N                   | 5754 623    | Fe        | 0                       |
| 5741 927    |           | 0000                    | 5754 881 s  | Ni        | 5                       |
| 5742 068 s  | Fe        | 2                       | 5755 133    |           | 000 N                   |
| 5742 293    |           | 000                     | 5755 370    | A         | 000 N                   |
| 5742 420    | A         | 0                       | 5755 585    | A         | 000 N                   |
| 5742 785    | A,-       | 000 N                   | 5755 701    | A         | 000                     |
| 5743 025    |           | 0000                    | 5755 970    | A         | 000                     |
| 5743 182    |           | 0                       | 5756 182    | A         | 000                     |
| 5743 410    |           | 00 Nd?                  | 5756 410    | A?        | 0000                    |
| 5743 645    |           | 00                      | 5757 037    | Fe        | 2                       |
| 5743 774    | -, A?     | 00                      | 5757 293    | A         | 000                     |
| 5743 961    | A         | 000                     | 5758 161    | A         | 000                     |
| 5744 153    |           | 00                      | 5758 493    | A         | 000                     |
| 5744 416    |           | 0000                    | 5758 654    | A         | 000                     |
| 5744 679    |           | 0000                    | 5758 978    |           | 000                     |
| 5744 995    | A         | 000                     | 5759 120    | A         | 000                     |
| 5745 165    | A         | 00                      | 5759 338    | A         | 000                     |
| 5745 290    | A         | 000                     | 5759 488    |           | 0                       |
| 5745 491    | A         | 000 N                   | 5759 760    |           | 0                       |
| 5745 706    | A         | 000 N                   | 5760 403    |           | 0000                    |
| 5745 932    | A         | 00                      | 5760 572    | Fe        | 1                       |
| 5745 997    | A         | 1                       | 5760 748    |           | 000                     |
| 5746 638    | A,-       | 000                     | 5760 914    | A?        | 0000                    |
| 5747 025    | A         | 000 Nd?                 | 5761 052    | Ni        | 2                       |
| 5747 502    | A         | 000                     | 5761 305    |           | 000                     |
| 5747 890    |           | 1                       | 5761 485    | , A?      | 000                     |
| 5748 075    |           | 000                     | 5761 637    |           | 0000                    |
| 5748 176    | Fe        | 2                       | 5761 800    | A         | 0                       |
| 5748 380    |           | 000 Nd?                 | 5762 062    |           | 0000                    |
| 5748 576    | Ni        | 2                       | 5762 479    | Li        | 000 Nd?                 |
| 5748 737    |           | 0000                    | 5762 635    | Fe        | 1                       |
| 5748 941    |           | 0000                    | 5762 840    | A         | 00 N                    |
| 5749 110    |           | 000                     | 5763 058    |           | 0                       |
| 5749 513    |           | 00                      | 5763 218 s  | Fe        | 6                       |
| 5749 850    |           | 000                     | 5763 460    | A         | 000                     |
| 5750 270    | A,-       | 000 N                   | 5763 625    | A,        | 00                      |
| 5750 427    |           | 0000                    | 5766 080    | A?        | 000                     |
| 5750 723    | A         | 000                     | 5766 485    | -A?       | 000                     |
| 5750 852    |           | 0000                    | 5766 550    | Li        | 0                       |
| 5751 357    |           | 0000                    | 5766 808    |           | 0000                    |
| 5752 018    | A         | 000 N                   | 5767 358    | A         | 0                       |
| 5752 254 s  | Fe        | 4                       | 5768 225    | A         | 000 N                   |
| 5752 459    | A?        | 000 Nd?                 | 5768 575    | A         | 000 N                   |
| 5753 105    | A         | 000 N                   | 5769 120    |           | 000 N                   |
| 5753 344 s  | Fe        | 5                       | 5769 295    | A,-       | 000                     |
| 5753 610    |           | 000 N                   | 5769 547    |           | 0                       |
| 5753 860    | Cr        | 1 N                     | 5769 692    |           | 0000                    |
| 5754 193    | A?        | 000 N                   | 5769 900    | A         | 0000                    |

| Wave length | Substance          | Intensity<br>and<br>Character | Wave length             | Substance           | Intensity<br>and<br>Character |
|-------------|--------------------|-------------------------------|-------------------------|---------------------|-------------------------------|
| 5770 405    | A                  | 00 N                          | 5782 313 } <sub>s</sub> | Cu?                 | 3                             |
| 5770 714    | A-                 | 000 Nd?                       | 5782 390 }              |                     | 3                             |
| 5771 008    | A                  | 0000                          | 5782 582                |                     | 000 N                         |
| 5771 382    | A                  | 000                           | 5782 815                | Cr                  | 000 N                         |
| 5771 595    | A                  | 000                           | 5783 078                |                     | 000 N                         |
| 5771 820    |                    | 00                            | 5783 288                |                     | 2                             |
| 5772 040    |                    | 0000 Nd?                      | 5783 463                |                     | 000                           |
| 5772 364 s  | Si                 | 3                             | 5783 697                |                     | 0000 N                        |
| 5772 630    |                    | 000                           | 5783 888                | Cl                  | 0000                          |
| 5772 800    | A                  | 000                           | 5784 080 s              |                     | 3                             |
| 5772 889    |                    | 0000                          | 5784 268                |                     | 000 N                         |
| 5773 155    | A                  | 00                            | 5784 605                | Fe                  | 000 N                         |
| 5773 363    | A                  | 00                            | 5784 879                |                     | 1                             |
| 5773 718    | A-                 | 000 N                         | 5785 036                |                     | 000                           |
| 5773 982    |                    | 0000 N                        | 5785 188                | Cl                  | 2                             |
| 5774 250    | Γ <sub>1</sub> , A | 0                             | 5785 498                | Fe                  | 3                             |
| 5774 457    | A,                 | 00 N                          | 5785 772                | Cr                  | 00 N                          |
| 5774 761    |                    | 0000 N                        | 5785 952                |                     | 1                             |
| 5775 020    |                    | 0000 N                        | 5786 193                | Γ <sub>1</sub> , Cr | 0 N                           |
| 5775 304 s  | Fe                 | 4                             | 5786 373                | Cr                  | 000                           |
| 5775 521    |                    | 0000                          | 5786 747                |                     | 000 Nd?                       |
| 5775 833    |                    | 0000                          | 5786 964                |                     | 0000 N                        |
| 5775 969    | A                  | 0000                          | 5787 235                |                     | 00                            |
| 5776 292    | A                  | 000                           | 5787 488                |                     | 000                           |
| 5776 468    | A,                 | 000                           | 5787 941                | Cr                  | 000 N                         |
| 5776 958    | A,                 | 000 N                         | 5788 141 s              |                     | 4                             |
| 5777 737    |                    | 000 N                         | 5788 305                | A (O)               | 000                           |
| 5777 975    |                    | 000                           | 5788 398                | A (O)               | 00                            |
| 5778 222    |                    | 0000                          | 5788 504                | A (O)               | 000                           |
| 5778 505    |                    | 0000                          | 5788 611                | Cr, A (O)           | 00                            |
| 5778 677    | Fe                 | 1                             | 5788 755                | A (O)               | 0                             |
| 5778 890    | A                  | 000 N                         | 5788 865                | A?                  | 0000                          |
| 5779 025    | A?                 | 000                           | 5788 990                | A (O)               | 00                            |
| 5779 406    |                    | 0000                          | 5789 095                | A (O)               | 00                            |
| 5779 583    | A                  | 000                           | 5789 210                | A (O)               | 000                           |
| 5779 778    |                    | 0000                          | 5789 418 <sup>*</sup>   | A (O)               | 0 d                           |
| 5779 913    |                    | 000                           | 5789 565                | A?                  | 0000                          |
| 5780 176    | A                  | 0000                          | 5789 700                | A (O)               | 000                           |
| 5780 378    | A                  | 000                           | 5789 850                | A?                  | 0000                          |
| 5780 520    |                    | 000                           | 5789 978                | A?                  | 0000                          |
| 5780 600    |                    | 0                             | 5790 071                | A (O)               | 0                             |
| 5780 825    | Fe                 | 2                             | 5790 186                | A?                  | 0000                          |
| 5781 024    | Fe                 | 0                             | 5790 313                | A (O)               | 0                             |
| 5781 130    | Cr, 1 <sub>1</sub> | 00                            | 5790 307                | -, A (O)            | 00                            |
| 5781 288    |                    | 0000                          | 5790 581                | A (O)               | 000                           |
| 5781 400    | Cr                 | 0                             | 5790 759                | A (O)               | 000                           |
| 5781 573    |                    | 0000                          | 5790 878                | A?                  | 000                           |
| 5781 763    |                    | 0000                          | 5790 985                | A (O)               | 00                            |
| 5781 967    | Cr                 | 0                             | 5791 174 } <sub>s</sub> | Cl                  | 4                             |
| 5782 138    |                    | 000                           | 5791 243 }              | Fe                  | 3                             |

<sup>\*</sup> Principal line in the head of the δ group (atmospheric oxygen)

TABLE OF SOLAR SPECTRUM WAVE-LENGTHS 115

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 5791 405    |           | 000                     | 5803 802    |           | 0000 N                  |
| 5791 485    | A (O)     | 00                      | 5804 045    |           | 0000 N                  |
| 5791 620    | A?        | 0000                    | 5804 254    | Fe        | 1                       |
| 5791 750    | , A       | 0                       | 5804 479    | 11        | 0                       |
| 5791 974    |           | 000                     | 5804 681    | Fe        | 0                       |
| 5792 140    | A (O)     | 00                      | 5804 996    |           | 0000                    |
| 5792 311    | A?        | 0000                    | 5805 198    |           | 0000                    |
| 5792 405    | A?        | 0000                    | 5805 441 s  | Ni        | 4                       |
| 5792 829    | A?        | 0000                    | 5805 638    |           | 000                     |
| 5792 984    | A (O)     | 00                      | 5805 840    | A (O)     | 0                       |
| 5793 005    |           | 000                     | 5805 986    | 1 a       | 0                       |
| 5793 085    |           | 0000                    | 5806 261    | A?        | 0000 N                  |
| 5793 292    |           | 3                       | 5806 510    | A (O)     | 0                       |
| 5793 610    | A (O)-    | 000                     | 5806 747    |           | 0000                    |
| 5793 920    | A?        | 000                     | 5806 950 s  | Fe        | 5                       |
| 5794 137    | Fe        | 2                       | 5807 172    | C?        | 0000                    |
| 5794 375    |           | 0000 N                  | 5807 309    | C?        | 000                     |
| 5794 562    |           | 0000                    | 5807 465    | C?        | 0000                    |
| 5794 664    |           | 000 N                   | 5807 809    |           | 0000 N                  |
| 5794 839    |           | 0000 N                  | 5808 015    | A,-       | 0                       |
| 5795 086    |           | 0000                    | 5808 207    |           | 00                      |
| 5795 212    |           | 000                     | 5808 406    | A?        | 0000                    |
| 5795 508    |           | 0000                    | 5808 526    | A?        | 0000                    |
| 5796 102    |           | 000                     | 5808 781    | A?        | 0000 N                  |
| 5796 304 *  | Ni, A (O) | 0                       | 5809 085    | A (O)     | 00                      |
| 5796 486    |           | 0000                    | 5809 256    |           | 0000                    |
| 5796 635    |           | 00                      | 5809 439 s  | Fe        | 4                       |
| 5796 885    |           | 000                     | 5809 670    |           | 000 N                   |
| 5796 985    |           | 00                      | 5809 741    | A (O)     | 00                      |
| 5797 263    |           | 0000                    | 5809 830    |           | 000 N                   |
| 5797 497    | A?        | 0000                    | 5810 090    |           | 000 N                   |
| 5797 715    | A (O)     | 00                      | 5811 010    |           | 00                      |
| 5797 815    | Ti?       | 000                     | 5811 823    |           | 000 Nd?                 |
| 5798 077 s  |           | 3                       | 5812 139    | Fe        | 0                       |
| 5798 220    | A?        | 000                     | 5812 345    |           | 0000 N                  |
| 5798 398 s  | Fe, A (O) | 4                       | 5812 418    |           | 0000                    |
| 5798 728    | A,        | 000                     | 5812 616    | A (O),-   | 00                      |
| 5799 154    | A?        | 0000                    | 5812 719    |           | 0000                    |
| 5799 382    | A?        | 0000                    | 5812 942    |           | 0000                    |
| 5799 730    | A?        | 0000                    | 5813 060    |           | 000                     |
| 5800 055    | A         | 0000                    | 5813 270    | A (O),-   | 00                      |
| 5800 185    | A (O)     | 00                      | 5813 553    |           | 0000 N                  |
| 5800 443    | A-        | 000 Nd?                 | 5813 884    |           | 000                     |
| 5800 844    | -, A (O)  | 0                       | 5814 228    |           | 00                      |
| 5801 058    | A,        | 0000                    | 5814 788    |           | 0000                    |
| 5801 483    |           | 00 Nd?                  | 5815 030    | Fe        | 1                       |
| 5801 965    | A,        | 000 N                   | 5815 246    |           | 0000 Nd?                |
| 5802 546    | A?        | 0000 N                  | 5815 441    | Fe        | 0                       |
| 5802 885    | A (O)     | 0                       | 5815 663    |           | 0000                    |
| 5803 549    | A (O)     | 0                       | 5815 766    |           | 0000                    |

\*First line in the tail of the  $\delta$  group (atmospheric oxygen) mixed with a solar line.

| Wave length | Substance  | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|------------|-------------------------|-------------|-----------|-------------------------|
| 5815 870    |            | 00                      | 5834 440    | A (O)?    | 0000                    |
| 5816 086    |            | 000                     | 5834 756    |           | 000                     |
| 5816 289    |            | 0                       | 5835 070    | -, A (O)? | 0000 N                  |
| 5816 481    | , A (O)    | { 00                    | 5835 325    |           | 0                       |
| 5816 601 s  | Fe         | { 5                     | 5835 475    |           | 000                     |
| 5816 845    |            | 0000Nd?                 | 5835 645    |           | 00                      |
| 5817 057    | A (O), Mn? | 00                      | 5835 800    |           | 000                     |
| 5817 299    |            | 0                       | 5836 360    |           | 0000 N                  |
| 5817 593    |            | 0000                    | 5836 990    |           | 000                     |
| 5817 708    |            | 000                     | 5837 425    |           | 000                     |
| 5819 517    |            | 0000                    | 5837 925    | Fe        | 0                       |
| 5819 779    |            | 0000 N                  | 5838 225    |           | 000                     |
| 5820 145    |            | 00                      | 5838 378    |           | 00                      |
| 5820 510    | A (O)      | 000                     | 5838 592    | Fe        | 1                       |
| 5821 110    | A (O)      | 000                     | 5838 770    | A         | 000                     |
| 5822 107    |            | 00 N                    | 5838 896    |           | 00                      |
| 5822 680    |            | 00 N                    | 5839 154    | , A       | 0000                    |
| 5823 079    |            | 000                     | 5839 600    | A         | 000                     |
| 5823 388    |            | 000                     | 5839 823    |           | 00                      |
| 5823 575    |            | 0000                    | 5841 050    | A         | 000                     |
| 5823 910    |            | 00                      | 5841 405    |           | 000                     |
| 5824 388    |            | 000                     | 5842 600    |           | 000                     |
| 5824 628    |            | 00                      | 5842 756    | A         | 00                      |
| 5824 858    | A (O)      | 000                     | 5843 110    |           | 00                      |
| 5825 511    | A (O)      | 000                     | 5843 438    |           | 00                      |
| 5825 975    |            | 00                      | 5843 869    | A?        | 0000                    |
| 5826 328    |            | 0000                    | 5844 057    | A?        | 0000                    |
| 5826 545    |            | 000                     | 5844 405    | A?        | 000                     |
| 5826 860    |            | 000 N                   | 5844 828    |           | 00                      |
| 5827 299    |            | 0000                    | 5845 140    |           | 00                      |
| 5827 597    |            | 000 }                   | 5845 509    |           | 0                       |
| 5827 689    |            | 00 }                    | 5845 696    | A         | 000                     |
| 5827 897    | A          | 000                     | 5845 965    | A?        | 0000                    |
| 5828 097    |            | 0                       | 5846 185    |           | 00                      |
| 5828 460    | A          | 000                     | 5846 487    |           | 00                      |
| 5828 979    |            | 0000 Nd?                | 5846 780    |           | 0000                    |
| 5829 533    | , A (O)?   | 0000 N                  | 5847 016    |           | 0000                    |
| 5830 198    |            | 0000 }                  | 5847 221    | Ni        | 1                       |
| 5830 305    | A (O)      | 000 }                   | 5847 477    |           | 0000                    |
| 5830 895    |            | 000                     | 5847 775    |           | 0000Nd?                 |
| 5831 468    | A (?)      | 0000                    | 5848 105    |           | 0000Nd?                 |
| 5831 821    | Ni         | 1                       | 5848 342    | Fe        | 1                       |
| 5831 967    |            | 000                     | 5848 662    |           | 0000                    |
| 5832 155    |            | 000 N                   | 5848 888    | A         | 000                     |
| 5832 490    |            | 000 N                   | 5849 187    |           | 000                     |
| 5832 691    |            | 000                     | 5849 415    |           | 000                     |
| 5833 188    |            | 0000                    | 5849 909    |           | 0                       |
| 5833 886    |            | 0000 N                  | 5850 145    |           | 000                     |
| 5834 145    |            | 000                     | 5850 320    |           | 000                     |
| 5834 251    |            | 0                       | 5850 553    | A         | 0000                    |



| Wave length | Substance           | Intensity and Character | Wave length | Substance        | Intensity and Character |
|-------------|---------------------|-------------------------|-------------|------------------|-------------------------|
| 5851 025    | A                   | 00 N                    | 5865 027    | A                | 000                     |
| 5851 220    | A                   | 000                     | 5865 109    |                  | 0000                    |
| 5851 427    |                     | 0                       | 5865 633    | A (wv)           | 000                     |
| 5852 005    |                     | 0000 N                  | 5865 852    | A (wv)           | 00                      |
| 5852 223    |                     | 0000 N                  | 5866 068    | A (wv)           | 000 }                   |
| 5852 443    | Fe                  | 3                       | 5866 172    | A (wv)           | 000 }                   |
| 5852 789    |                     | 000 N                   | 5866 363    | A (wv)           | 000 }                   |
| 5853 378    |                     | 0                       | 5866 483    |                  | 000 }                   |
| 5853 538    |                     | 000                     | 5866 675    | I <sub>1</sub>   | 3                       |
| 5853 690    |                     | 000 N                   | 5866 857    |                  | 0000                    |
| 5853 902 s  | Ba <sup>2</sup>     | 5                       | 5866 959    |                  | 0000                    |
| 5854 168    | A                   | 0000                    | 5867 221    |                  | 0000                    |
| 5854 327    | A <sup>2</sup>      | 0000                    | 5867 302    |                  | 00 N                    |
| 5854 535    |                     | 000                     | 5867 550    |                  | 000 N                   |
| 5854 811    | A <sub>2</sub>      | 000                     | 5867 785    | Ca               | 2                       |
| 5855 060    | A                   | 000                     | 5868 010    |                  | 0000                    |
| 5855 300    | Fe                  | 1                       | 5868 132    |                  | 0000                    |
| 5855 476    |                     | 0000                    | 5868 362    |                  | 0000                    |
| 5855 567    | A <sup>2</sup>      | 0000                    | 5868 507    |                  | 0000                    |
| 5855 755    |                     | 0000 Nd?                | 5868 988    | A                | 00 N                    |
| 5856 105    |                     | 0000                    | 5869 320    |                  | 0000                    |
| 5856 312    | Fe                  | 2                       | 5869 566    | A                | 0000                    |
| 5856 645    |                     | 0000 N                  | 5869 888    | A                | 000                     |
| 5856 838    |                     | 0000                    | 5870 008    | A (wv)           | 00                      |
| 5857 674 s  | Ca                  | 8                       | 5870 864    | A (wv)           | 1                       |
| 5857 976    | Ni                  | 3                       | 5871 103    |                  | 0000                    |
| 5858 205    |                     | 000 N                   | 5871 305    | A (wv)           | 000                     |
| 5858 495    |                     | 00                      | 5871 523    | A (wv), -        | 0                       |
| 5858 750    |                     | 000 N                   | 5872 000    | A                | 000                     |
| 5859 001    |                     | 0                       | 5872 247    | A                | 000                     |
| 5859 215    | , A                 | 000 N                   | 5872 427    | A                | 000                     |
| 5859 463    |                     | 000                     | 5872 490    | A <sup>2</sup>   | 0000 N                  |
| 5859 620    |                     | 0000                    | 5873 343    |                  | 0000                    |
| 5859 809 s  | Fe                  | 5                       | 5873 436    |                  | 1                       |
| 5860 176    |                     | 0000                    | 5873 630    |                  | 0000                    |
| 5860 306    | A <sup>2</sup>      | 0000                    | 5873 790    | A (wv)           | 0                       |
| 5861 331    |                     | 0                       | 5873 988    |                  | 00 N                    |
| 5861 845    | A (wv) <sup>2</sup> | 0                       | 5874 175    | A (wv)           | 000                     |
| 5862 021    | A                   | 000                     | 5874 697    | A <sup>2</sup>   | 0000                    |
| 5862 582 s  | Fe                  | 6                       | 5874 865    | A (wv)           | 000                     |
| 5862 817    |                     | 0000                    | 5874 995    |                  | 0000 N                  |
| 5863 075    |                     | 000 N                   | 5875 360    | A (wv)           | 00 N                    |
| 5863 380    | A                   | 000                     | 5875 660    | , A <sup>2</sup> | 0000                    |
| 5863 685    | A                   | 000                     | 5875 815    | A (wv)           | 0                       |
| 5863 933    |                     | 0000                    | 5875 985    | -, A (wv)        | 0000 N                  |
| 5864 167    |                     | 000                     | 5876 338    | A (wv)           | 1                       |
| 5864 268    |                     | 0000                    | 5876 514    |                  | 00                      |
| 5864 463    |                     | 0                       | 5876 664    | A (wv)           | 0                       |
| 5864 575    | A                   | 000                     | 5876 770    |                  | 0000                    |
| 5864 742    |                     | 0000                    | 5877 027    |                  | 0000                    |

<sup>2</sup> A (wv) stands for an atmospheric line due to water-vapor

| Wave-length             | Substance | Intensity and Character | Wave length                            | Substance | Intensity and Character |
|-------------------------|-----------|-------------------------|--|-----------|-------------------------|
| 5877 273                | A         | 000                     | 5885 973                               | A?        | 0000                    |
| 5877 547                | A (wv)    | 00                      | 5886 193                               | A (wv)    | 5                       |
| 5877 640                |           | 0000 Nd?                | 5886 390                               |           | 0000                    |
| 5877 780                | A (wv)    | 000                     | 5886 560                               | A (wv)    | 1                       |
| 5877 903                |           | 0000                    | 5886 620                               | A (wv)    | 0                       |
| 5878 015                |           | 0                       | 5886 905                               | A (wv)    | 0                       |
| 5878 245                |           | 000 N                   | 5887 045                               | A         | 000                     |
| 5878 504                | A         | 0000                    | 5887 445                               | A (wv)    | 5                       |
| 5878 790                |           | 0000 N                  | 5887 690                               |           | 000                     |
| 5879 225                | A         | 0000 N                  | 5887 880                               | A (wv)    | 3                       |
| 5879 417                | A (wv)    | 00                      | 5888 056                               | A (wv)    | 00                      |
| 5879 506                |           | 0000                    | 5888 404                               |           | 0000                    |
| 5879 715                |           | 00                      | 5888 655                               |           | 0000                    |
| 5879 820                | A (wv)    | 1                       | 5888 920                               | A (wv)    | 2                       |
| 5879 945                | A (wv)    | 1                       | 5889 110                               |           | 0000                    |
| 5880 035                |           | 0000                    | 5889 303                               | A (wv)    | 00                      |
| 5880 250                |           | 0 N                     | 5889 587                               |           | 0000 N                  |
| 5880 490                |           | 00                      | 5889 855                               | A (wv)    | 3                       |
| 5880 649                |           | 0000                    | 5890 100 <sup>2</sup>                  | A (wv)    | 2                       |
| 5880 725                | A (wv)    | 00                      | 5890 186 D <sub>2</sub> <sup>1,2</sup> | Na        | 30                      |
| 5880 832                |           | 0000                    | 5890 425                               | A (wv)    | 0                       |
| 5880 948                | A (wv)    | 0                       | 5890 529                               |           | 000                     |
| 5881 147                | A (wv)    | 1                       | 5890 720                               |           | 00 Nd?                  |
| 5881 320                | A (wv)    | 0                       | 5890 950                               | A (wv)    | 00 Nd?                  |
| 5881 500                |           | 0                       | 5891 125                               | A?        | 0000 Nd?                |
| 5881 636                | A         | 000                     | 5891 398                               | A (wv),-  | 1                       |
| 5881 760                |           | 0000                    | 5891 581                               |           | 0000                    |
| 5881 940                |           | 000                     | 5891 720                               | A (wv)    | 0                       |
| 5882 084                | A (wv)    | 1                       | 5891 878                               | A (wv)    | 4                       |
| 5882 203                | A (wv)    | 0                       | 5892 108                               |           | 000                     |
| 5882 412                | A         | 0000 N                  | 5892 271                               | A?        | 0000                    |
| 5882 589                | A         | 000                     | 5892 493                               | A?        | 0000                    |
| 5882 708                | A         | 000                     | 5892 608                               | A (wv)    | 3                       |
| 5883 025                | A (wv)    | 0                       | 5892 690                               |           | 000                     |
| 5883 218                | A (wv)    | 00                      | 5892 920                               | Fe        | 00                      |
| 5883 285                |           | 000                     | 5893 097 <sup>s</sup>                  | Ni        | 4 d?                    |
| 5883 529                |           | 0000                    | 5893 268                               | A (wv)    | 0                       |
| 5883 589                | A?        | 000 N                   | 5893 455                               |           | 000                     |
| 5883 655                |           | 0000 N                  | 5893 725                               | A (wv)    | 1                       |
| 5883 790                |           | 0000 N                  | 5894 050                               | A?        | 0000                    |
| 5884 028 } <sup>s</sup> | Fe        | 4                       | 5894 360                               | A?        | 0000                    |
| 5884 120 }              | A (wv)    | 5                       | 5894 605                               | A (wv)    | 0                       |
| 5884 245                |           | 0000                    | 5894 820                               | A (wv)    | 0000 N                  |
| 5884 410                | A (wv)    | 0                       | 5895 162                               | A (wv)    | 0                       |
| 5884 655                |           | 000                     | 5895 360                               | A (wv)    | 0                       |
| 5884 960                | A         | 000                     | 5895 582                               |           | 0000                    |
| 5885 278                |           | 00                      | 5895 901                               |           | 00 N                    |
| 5885 596                |           | 000                     | 5896 155                               | Na        | 20                      |
| 5885 733                | A (wv)    | 000                     | 5896 357 D <sub>1</sub> <sup>s3</sup>  |           | 00 N                    |
| 5885 840                | A (wv)    | 00                      | 5896 506                               |           | 000                     |

<sup>2</sup> This line is coincident with the edge of D<sub>2</sub> toward the violet and is therefore very difficult to see

<sup>2</sup> The width of D<sub>2</sub> is 0 175

<sup>3</sup> The width of D<sub>1</sub> is 0 160

| Wave length  | Substance      | Intensity and Character | Wave length | Substance | Intensity and Character |
|--------------|----------------|-------------------------|-------------|-----------|-------------------------|
| 5896 635     | A (wv)         | 0                       | 5905 148    |           | 0000                    |
| 5896 710     | A (wv)         | 1                       | 5905 335    | A (wv)    | 00                      |
| 5896 857     |                | 0000                    | 5905 505    | A (wv)    | 0                       |
| 5897 047     | A (wv)         | 2                       | 5905 583    | A (wv)    | 00                      |
| 5897 300     | A (wv)         | 00                      | 5905 652    |           | 0000                    |
| 5897 400     |                | 0000                    | 5905 745    | A?        | 0000                    |
| 5897 470     |                | 00                      | 5905 895 s  | Fe        | 4                       |
| 5897 677     | A (wv)         | 0                       | 5906 130    | A?        | 0000Nd?                 |
| 5897 750     |                | 000                     | 5906 390    | A (wv)    | 000                     |
| 5897 970     | A (wv)         | 00                      | 5906 505    | A (wv)    | 000                     |
| 5898 160     | A (wv)         | 00                      | 5906 733    |           | 000                     |
| 5898 378 } s | A (wv)         | 4                       | 5906 864    |           | 0000                    |
| 5898 430 } s |                | 00                      | 5907 060    |           | 0                       |
| 5898 615     | A (wv)         | 000                     | 5907 220    | A (wv)    | 00                      |
| 5898 745     |                | 0000                    | 5907 475    | A (wv)    | 0                       |
| 5898 980     | A (wv)         | 00                      | 5907 574    | A (wv)    | 000                     |
| 5899 011     | A?             | 0000                    | 5907 692    | A (wv)    | 00                      |
| 5899 215     | A (wv)         | 2                       | 5907 873    |           | 0000                    |
| 5899 315     |                | 0000                    | 5908 070    | A (wv),-  | 1                       |
| 5899 518     | T <sub>1</sub> | 1                       | 5908 258    | A?        | 0000                    |
| 5899 752     | A (wv)         | 00                      | 5908 425    | A (wv)    | 1                       |
| 5899 887     |                | 000                     | 5908 640    | A?        | 0000                    |
| 5900 135     | A (wv)         | 2                       | 5908 795    | A?        | 0000                    |
| 5900 260     | A (wv)         | 4                       | 5908 945    |           | 0000                    |
| 5900 585     | A?             | 0000                    | 5909 020    |           | 0000                    |
| 5900 648     | A (wv)         | 000                     | 5909 213    | A (wv)    | 3                       |
| 5900 981     | A?             | 0000                    | 5909 395    |           | 0000                    |
| 5901 140     | A (wv)         | 00                      | 5909 668    | A (wv)    | 00                      |
| 5901 296     | A?             | 0000                    | 5909 878    | A?        | 0000                    |
| 5901 465     | A (wv)         | 00                      | 5910 060    | A?        | 0000                    |
| 5901 682 } s | A (wv)         | 6                       | 5910 197    | Fe        | 1                       |
| 5901 745 } s |                | 00                      | 5910 398    | A (wv)    | 1                       |
| 5901 926     |                | 0000                    | 5910 528    | A (wv)    | 000                     |
| 5902 028     |                | 0000                    | 5910 700    | A (wv)    | 00                      |
| 5902 238     | A (wv)         | 000 N                   | 5910 855    | A (wv)    | 00                      |
| 5902 363     | A (wv)         | 1                       | 5910 987    | A (wv)    | 2                       |
| 5902 465     |                | 000                     | 5911 140    | A (wv)    | 000                     |
| 5902 694     | Fe             | 0                       | 5911 365    |           | 0000                    |
| 5902 870     | A?             | 0000                    | 5911 435    | A (wv)    | 000                     |
| 5903 035     | A (wv)         | 000                     | 5911 710    | A (wv)    | 000                     |
| 5903 334     |                | 0000                    | 5911 810    | A?        | 0000                    |
| 5903 555     |                | 00                      | 5912 093    | A (wv)    | 00                      |
| 5903 748     | A (wv)         | 1                       | 5912 228    | A (wv)    | 00                      |
| 5903 918     | A (wv)         | 00                      | 5912 345    |           | 000                     |
| 5904 070     | A (wv)         | 00                      | 5912 757    | A (wv)    | 000                     |
| 5904 160     | A (wv)         | 00                      | 5912 918    | A (wv)    | 0                       |
| 5904 420     | A?             | 0000                    | 5913 212    | A (wv)    | 3                       |
| 5904 592     | A (wv)         | 000                     | 5913 358    | A?        | 0000                    |
| 5904 850     | A?             | 0000                    | 5913 570    |           | 0000                    |
| 5905 050     | A?             | 000                     | 5913 930    | A?        | 000                     |

# PRELIMINARY TABLE OF SOLAR SPECTRUM WAVE-LENGTHS XI

By HENRY A. ROWLAND

| Wave length  | Substance      | Intensity and Character | Wave length | Substance | Intensity and Character |
|--------------|----------------|-------------------------|-------------|-----------|-------------------------|
| 5914 118     |                | 0000                    | 5922 578    | A (wv)    | 0                       |
| 5914 335 } s | Fe             | 4                       | 5922 735    | A (wv)    | 2                       |
| 5914 430 } s | -, A (wv)      | 6                       | 5922 930    | A (wv)    | 0                       |
| 5914 700     | A?             | 0000                    | 5923 235    |           | 0000                    |
| 5914 850     |                | 0000                    | 5923 405    | A (wv)    | 00                      |
| 5915 146     | A (wv)         | I                       | 5923 500    |           | 0000                    |
| 5915 380     |                | 0000                    | 5923 702    |           | 0000                    |
| 5915 650     | A (wv)         | I                       | 5923 865    | A (wv)    | I                       |
| 5915 840     | A (wv)         | I                       | 5924 040    | A (wv)    | 2                       |
| 5916 050     | A (wv)         | 000                     | 5924 180    |           | 000                     |
| 5916 240     | A (wv)         | 00                      | 5924 490    | A (wv)    | 4                       |
| 5916 475 s   | Fe             | 3                       | 5924 787    |           | 0000                    |
| 5916 675     |                | 0000                    | 5924 975    | A (wv)    | 000                     |
| 5916 800     | A (wv)         | 0                       | 5925 082    |           | { 0000                  |
| 5916 984     | A (wv),-       | 000                     | 5925 220    | A (wv)    | { 2                     |
| 5917 093     | A?             | 000                     | 5925 460    |           | 0000                    |
| 5917 365     | -, A?          | 0000 N                  | 5925 799    | A?        | 0000                    |
| 5917 605     | A (wv)         | 0                       | 5926 048    |           | 0000                    |
| 5917 827     |                | 0000                    | 5926 244    |           | 0000                    |
| 5918 022     |                | 0000                    | 5926 418    |           | 0000                    |
| 5918 225     | A (wv)         | 00 d                    | 5926 835    | A (wv)    | 000                     |
| 5918 420     | A?             | 0000                    | 5927 040    | A?, -     | 0000                    |
| 5918 635     | A (wv)         | 4                       | 5927 425    |           | 0000                    |
| 5918 773     | T <sub>1</sub> | 0                       | 5927 750    |           | 0000                    |
| 5918 980     |                | 0000 N                  | 5928 013    | Fe        | 2                       |
| 5919 175     | A (wv)         | 000                     | 5928 280    |           | 000                     |
| 5919 276     | A (wv)         | 5                       | 5928 510    | A (wv)    | 2                       |
| 5919 505     |                | 0000                    | 5928 740    |           | 0000                    |
| 5919 585     | A?             | 0000                    | 5928 890    | A?        | 0000                    |
| 5919 860 s   | A (wv)         | 7                       | 5929 056    | A (wv)    | 000                     |
| 5920 060     | A?             | 0000                    | 5929 100    |           | 000                     |
| 5920 395     | A (wv)         | 00                      | 5929 350    | A (wv)    | 00                      |
| 5920 546     | A?             | 0000                    | 5929 630    | A (wv)    | 000                     |
| 5920 776     | A (wv)         | I                       | 5929 898    | Fe        | 2                       |
| 5920 981     | A?             | 0000                    | 5930 145    | A?        | 0000                    |
| 5921 374     | A (wv)         | 00                      | 5930 225    |           | 0000                    |
| 5921 558     | A?             | 0000 N                  | 5930 406 s  | Fe        | 6                       |
| 5921 878     | A (wv)         | 0                       | 5930 640    |           | 0000                    |
| 5922 100     | A?             | 0000                    | 5930 815    | A (wv)    | 00                      |
| 5922 334     | T <sub>1</sub> | 0                       | 5930 980    |           | 0000                    |

| Wave length | Substance      | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|----------------|-------------------------|-------------|-----------|-------------------------|
| 5931 230    | A (wv)         | 00                      | 5942 635    | A (wv)    | I                       |
| 5932 118    |                | 0000                    | 5942 789    | A (wv)    | 3                       |
| 5932 306    | A (wv)         | 5                       | 5942 950    |           | 0000                    |
| 5932 456    | A?             | 0000                    | 5943 120    |           | 0000                    |
| 5932 699    | A?             | 0000                    | 5943 330    |           | 0000                    |
| 5932 998    | A (wv)         | 2                       | 5943 605    |           | 000                     |
| 5933 233    | A (wv)         | 0000                    | 5943 815    |           | 00                      |
| 5933 425    |                | 0000                    | 5944 065    |           | 0000                    |
| 5933 670    | A?             | 0000                    | 5944 230    |           | 0000                    |
| 5933 872    | A (wv)         | 000                     | 5944 530    | A (wv)    | I                       |
| 5934 024    |                | 000                     | 5944 713    |           | 0000                    |
| 5934 140    | A (wv)         | 000                     | 5944 945    | A (wv)    | I                       |
| 5934 300    | A (wv)         | 00                      | 5945 230    |           | 0000                    |
| 5934 490    |                | 0000                    | 5945 463    | A (wv)    | 00                      |
| 5934 655    |                | 0000                    | 5945 530    | A (wv)    | 00                      |
| 5934 881 s  | Fe             | 5                       | 5945 865    | A (wv)    | I                       |
| 5935 165    |                | 0000                    | 5946 104    | A?        | 0000                    |
| 5935 400    | A (wv)         | 00                      | 5946 223    | A (wv)    | 3                       |
| 5935 625    |                | 000                     | 5946 485    | A?        | 0000                    |
| 5935 863    | A?             | 0000                    | 5946 685    |           | 000                     |
| 5936 038    | A (wv)         | 0                       | 5946 864    | A (wv)    | 000                     |
| 5936 278    |                | 0000                    | 5947 062    | A (wv)    | I                       |
| 5936 428    | A?             | 0000 N                  | 5947 283    | A (wv)    | 2                       |
| 5937 183    |                | 0000                    | 5947 500    |           | 0000                    |
| 5937 345    | A (wv)         | 0000                    | 5947 644    | A (wv)    | 000                     |
| 5937 523    | A (wv)         | 000                     | 5947 730    |           | 00                      |
| 5937 670    | A (wv)         | 000                     | 5947 955    | A?        | 0000                    |
| 5938 035    |                | 000                     | 5948 195    | A?        | 0000                    |
| 5938 160    | A (wv)         | 000                     | 5948 452    | A (wv)    | 00                      |
| 5938 270    | A (wv)         | 0                       | 5948 765 s  | Si        | 6                       |
| 5938 500    | A (wv)         | 000                     | 5948 995    | A (wv)    | 000                     |
| 5938 810    | A (wv)         | 00                      | 5949 240    | A (wv)    | 0000                    |
| 5938 965    |                | 0000                    | 5949 390    | A (wv)    | 2                       |
| 5939 455    |                | 0000 N                  | 5949 566    | Fe        | I                       |
| 5939 633    |                | 0000                    | 5949 794    | A (wv)    | 000                     |
| 5939 967    |                | 0000                    | 5949 880    | A (wv),-  | 000                     |
| 5940 185    | A (wv)         | 0                       | 5950 040    | A (wv)    | 0                       |
| 5940 400    | A?             | 000                     | 5950 229    |           | 0000                    |
| 5940 640    | A (wv)         | I                       | 5950 356    | A (wv),-  | 00                      |
| 5940 875    |                | 0000 N                  | 5950 560    | A (wv)    | 0                       |
| 5941 091    | A (wv)         | 00                      | 5950 688    |           | 0000                    |
| 5941 210    |                | 0                       | 5951 070    | A?        | 0000                    |
| 5941 290    | A (wv)         | 5                       | 5951 181    | A (wv)    | 00                      |
| 5941 470    | A (wv)         | 000                     | 5951 310    |           | 0000                    |
| 5941 630    | A?             | 0000                    | 5951 440    | A (wv)    | 000                     |
| 5941 845    | A (wv)         | 2                       | 5951 530    | A (wv)    | 000                     |
| 5941 985    | T <sub>1</sub> | 00                      | 5951 718    | A (wv)    | 0                       |
| 5942 220    | A?             | 0000                    | 5952 015    |           | 0000                    |
| 5942 399    |                | 0000                    | 5952 406    |           | 0000                    |
| 5942 500    | A (wv)         | 000                     | 5952 578    | A?        | 000                     |

| Wave length | Substance      | Intensity and Character | Wave length | Substance           | Intensity and Character |
|-------------|----------------|-------------------------|-------------|---------------------|-------------------------|
| 5952 740    |                | 000                     | 5965 163    | A (wv)              | 00                      |
| 5952 943    | Fe             | 4                       | 5965 370    | A?                  | 0000                    |
| 5953 207    |                | 0000 N                  | 5965 543    | A?                  | 0000                    |
| 5953 386    | T <sub>1</sub> | 1                       | 5965 740    |                     | 0000                    |
| 5953 583    | A?             | 0000                    | 5966 055    | T <sub>1</sub> , A? | 2                       |
| 5953 680    | A (wv)         | 00                      | 5966 223    |                     | 0000                    |
| 5953 935    |                | 0000                    | 5966 430    | A (wv)              | 000                     |
| 5954 200    | A?             | 000                     | 5966 560    | A (wv)              | 0                       |
| 5954 595    | A (wv)         | 000                     | 5966 706    | A?                  | 0000                    |
| 5954 906    |                | 0000                    | 5966 885    | A (wv)              | 1                       |
| 5955 170    | A (wv)         | 1                       | 5967 218    | A?                  | 000                     |
| 5955 331    |                | 0000                    | 5967 540    | A (wv)              | 00                      |
| 5955 570    |                | 0000                    | 5967 720    |                     | 0000                    |
| 5955 890    |                | 0000                    | 5967 880    |                     | 000                     |
| 5956 039    | A (wv)         | 000                     | 5968 058    | A (wv)              | 2                       |
| 5956 252    | A (wv)         | 000                     | 5968 280    | A (wv)              | 000                     |
| 5956 364    | A (wv)         | 0000                    | 5968 495    | A (wv)              | 2                       |
| 5956 573    | A (wv)         | 0                       | 5968 630    |                     | 0000                    |
| 5956 715    |                | 0000                    | 5968 882    | A?                  | 0000                    |
| 5956 923 s  | Fe             | 4                       | 5969 260    | A (wv)              | 0                       |
| 5957 175    |                | 0000                    | 5969 510    | A?                  | 0000                    |
| 5957 253    |                | 0000                    | 5969 795    |                     | 000                     |
| 5957 365    | A?             | 0000                    | 5970 046    | A?                  | 0000                    |
| 5957 790    |                | 0000                    | 5970 280    | A (wv)              | 0                       |
| 5958 098    | A (wv)         | 1                       | 5970 480    | A?                  | 000                     |
| 5958 297    |                | 0000                    | 5970 714    |                     | 0000                    |
| 5958 460    | A (wv),-       | 1                       | 5970 908    | A (wv)              | 000                     |
| 5958 565    |                | 00                      | 5971 182    |                     | 0000                    |
| 5958 840    |                | 1                       | 5971 366    |                     | 0000                    |
| 5959 025    | A?             | 0000                    | 5971 557    | A (wv)              | 1                       |
| 5959 380    |                | 000                     | 5971 990    |                     | 0000                    |
| 5959 535    | A?             | 0000                    | 5972 970    |                     | 0000                    |
| 5959 830    |                | 000                     | 5973 203    |                     | 0000                    |
| 5959 940    |                | 000                     | 5973 578    |                     | 0000                    |
| 5960 200    | A?             | 0                       | 5973 695    |                     | 0000                    |
| 5960 560    |                | 0000                    | 5974 094    | N                   | 0000                    |
| 5960 800    |                | 0000                    | 5974 495    |                     | 0                       |
| 5961 444    |                | 0000                    | 5974 812    | N                   | 0000                    |
| 5961 665    | A (wv)         | 0                       | 5975 054    |                     | 0000                    |
| 5961 955    |                | 0000                    | 5975 330    | A (wv)              | 1                       |
| 5962 110    |                | 0000                    | 5975 413    |                     | 0000                    |
| 5962 390    | A?             | 000                     | 5975 575 s  | Fe                  | 3                       |
| 5962 516    | A?             | 0000                    | 5975 820    |                     | 0000                    |
| 5962 690    | A (wv)         | 0                       | 5976 046    |                     | 0000                    |
| 5962 840    |                | 0000                    | 5976 150    | A?                  | 000                     |
| 5963 134    |                | 0000                    | 5976 387    |                     | 0000                    |
| 5963 326    |                | 0000                    | 5976 504    |                     | 0000                    |
| 5963 406    | A?             | 000                     | 5976 694    | A (wv)              | 00                      |
| 5963 790    |                | 0000                    | 5976 730    | ,A?                 | 0                       |
| 5964 826    |                | 0000                    | 5977 007 s  | Fe                  | 4                       |

| Wave length | Substance      | Intensity and Character | Wave length | Substance               | Intensity and Character |
|-------------|----------------|-------------------------|-------------|-------------------------|-------------------------|
| 5977 252 s  | A (wv)         | 1 d?                    | 5989 313    | A?                      | 0000                    |
| 5977 513    |                | 0000                    | 5989 510    | A (wv)                  | 0                       |
| 5977 655    | A (wv)         | 00 N                    | 5989 788    |                         | 0000                    |
| 5978 033    | A (wv)         | 0                       | 5990 290    |                         | 000                     |
| 5978 292    |                | 0000                    | 5990 595    |                         | 0000                    |
| 5978 365    | A?             | 000                     | 5990 830    | A (wv)                  | 00                      |
| 5978 560    |                | 0000                    | 5991 070    | A (wv)                  | 0                       |
| 5978 768    | T <sub>1</sub> | 1                       | 5991 237    |                         | 0000 N                  |
| 5979 012    |                | 0000                    | 5991 600    |                         | 2                       |
| 5979 135    |                | 000 N                   | 5991 790    |                         | 0000                    |
| 5979 455    | A?             | 0000 N                  | 5992 010    |                         | 000                     |
| 5979 527    |                | 0000                    | 5992 218    | A (wv)                  | 0                       |
| 5979 915    |                | 0000 N d?               | 5992 409    |                         | 0000                    |
| 5980 395    | A (wv),        | 00                      | 5992 555    |                         | 0000                    |
| 5980 740    | A (wv)         | 000                     | 5992 900    |                         | 0000                    |
| 5980 965    | A?             | 0000                    | 5993 275    | A (wv)                  | 00                      |
| 5981 043    |                | 0000                    | 5993 674    |                         | 0000                    |
| 5981 450    | A?             | 00                      | 5993 875    |                         | 0000                    |
| 5981 614    |                | 0000                    | 5994 135    | A (wv)                  | 00                      |
| 5981 930    | A?             | 0000                    | 5994 563    |                         | 0000                    |
| 5982 085    |                | 000                     | 5994 756    | A (wv)                  | 0                       |
| 5982 200    |                | 0000                    | 5995 491    | A?                      | 0000 N                  |
| 5982 530    |                | 000                     | 5995 916    |                         | 0000                    |
| 5982 838    |                | 0000 N                  | 5996 164    |                         | 000 N                   |
| 5983 098    | A (wv)         | 00                      | 5996 247    |                         | 0000                    |
| 5983 525    | A (wv)         | 000                     | 5996 445    |                         | 0000                    |
| 5983 650    |                | 0000                    | 5996 725    |                         | 0000                    |
| 5983 908    | Fe             | 5                       | 5996 963    | N <sub>1</sub>          | 1                       |
| 5984 195    | A?             | 000                     | 5997 195    |                         | 0000                    |
| 5984 285    |                | 0000                    | 5997 438    |                         | 0000                    |
| 5984 495    |                | 000                     | 5997 578    | A (wv)                  | 0                       |
| 5984 660    |                | 0000                    | 5997 826    | A, N <sub>1</sub>       | 0                       |
| 5984 810    |                | 0000                    | 5998 002    | Fe                      | 2                       |
| 5985 040 s  | Fe             | 6                       | 5998 442    |                         | 000                     |
| 5985 435    | A (wv)         | 0                       | 5998 760    |                         | 0000                    |
| 5985 615    | A?             | 0000                    | 5999 115    |                         | 0000                    |
| 5985 731    | A?             | 0000                    | 5999 204    |                         | 000                     |
| 5985 924    | A?             | 0000 N                  | 5999 436    | A (wv)                  | 00                      |
| 5986 350    |                | 000                     | 5999 647    |                         | 0000 N                  |
| 5986 674    |                | 0000                    | 5999 920    | T <sub>1</sub> , A (wv) | 0                       |
| 5986 975    |                | 0000 N                  | 6000 269    |                         | 0000                    |
| 5987 290 s  | Fe             | 5                       | 6000 370    | A (wv)                  | 00                      |
| 5987 525    |                | 0000                    | 6000 900    | A?                      | 00                      |
| 5987 774    |                | 0000                    | 6001 345    | A?                      | 000                     |
| 5988 048    | A?             | 0000 N d?               | 6001 765    | A (wv)                  | 000                     |
| 5988 325    | A (wv)         | 000                     | 6002 375    | A (wv)                  | 000                     |
| 5988 574    | A?             | 0000                    | 6002 870    | A (wv)                  | 00                      |
| 5988 785    | A (wv)         | 0                       | 6002 970    |                         | 0000 N                  |
| 5988 985    |                | 000                     | 6003 239 s  | Fe                      | 6                       |
| 5989 180    |                | 0000                    | 6003 538    |                         | 0000                    |





| Wave length | Substance        | Intensity and Character | Wave length | Substance        | Intensity and Character |
|-------------|------------------|-------------------------|-------------|------------------|-------------------------|
| 6039 953    | V                | 0                       | 6063 316    |                  | 0000                    |
| 6040 190    |                  | 0000                    | 6063 522    |                  | 0000 N                  |
| 6042 198    |                  | 0000                    | 6064 258    |                  | 000 N                   |
| 6042 315 s  | $\frac{1}{2}$ Fe | 3                       | 6064 853    | Ti               | 00                      |
| 6042 480    |                  | 0000                    | 6065 709 s  | Fe               | 7                       |
| 6042 942    |                  | 0000                    | 6066 020    |                  | 0000                    |
| 6043 164    |                  | 0000                    | 6067 492    |                  | 0000                    |
| 6043 640    |                  | 000                     | 6067 850    |                  | 000                     |
| 6043 843    |                  | 0000                    | 6068 172    |                  | 0000                    |
| 6044 258    |                  | 0000 N                  | 6068 704    |                  | 0000                    |
| 6045 705    |                  | 000                     | 6069 931    |                  | 0000                    |
| 6045 985    |                  | 0000                    | 6070 303    |                  | 0000                    |
| 6046 245    |                  | 0 N                     | 6071 575    |                  | 0000                    |
| 6047 280    | A?               | 0000 N                  | 6071 970    |                  | 0000                    |
| 6047 880    |                  | 0000                    | 6072 238    |                  | 0000                    |
| 6048 495    | A?               | 0000 N                  | 6073 410    |                  | 0000                    |
| 6049 011    | A?               | 0000 N                  | 6073 772    |                  | 0000                    |
| 6049 337    |                  | 000 N                   | 6074 230    |                  | 0000                    |
| 6051 245    |                  | 0000 N                  | 6075 739    |                  | 0000                    |
| 6052 061    |                  | 0000 N                  | 6076 360    |                  | 000 Nd?                 |
| 6052 828    |                  | 000                     | 6076 820    |                  | 0000 N                  |
| 6052 906    |                  | 00                      | 6077 120    |                  | 00                      |
| 6053 153    |                  | 0000 N                  | 6077 480    |                  | 0000 N                  |
| 6053 233    |                  | 0000 N                  | 6077 702    |                  | 0000 N                  |
| 6053 476    |                  | 0000 N                  | 6078 060    |                  | 000 N                   |
| 6053 690    |                  | 000                     | 6078 410    |                  | 0000 N                  |
| 6053 912    | Ni               | 0                       | 6078 710 s  | Fe               | 5                       |
| 6054 125    |                  | 0000                    | 6078 978    |                  | 000 N                   |
| 6054 290    | A?               | 00                      | 6079 227 s  | $\frac{1}{2}$ Fe | 2                       |
| 6055 310    |                  | 000                     | 6080 230    |                  | 000                     |
| 6055 620    |                  | 000                     | 6080 450    |                  | 0000                    |
| 6055 980    |                  | 0000 N                  | 6080 794    |                  | 0000 N                  |
| 6056 227 s  | Fe               | 5                       | 6081 422    |                  | 0000 N                  |
| 6056 565    |                  | 000                     | 6081 665    | V                | 0                       |
| 6056 987    |                  | 0000 N                  | 6081 930    |                  | 0000                    |
| 6057 110    |                  | 0000                    | 6082 050    |                  | 0000                    |
| 6057 475    |                  | 00 N                    | 6082 640    | Co               | 000 Nd?                 |
| 6058 080    |                  | 0000                    | 6082 930    | Fe               | 1                       |
| 6058 385    |                  | 000 N d?                | 6083 915    |                  | 0000 N                  |
| 6058 874    |                  | 0000                    | 6084 325    |                  | 0                       |
| 6059 484    |                  | 0000                    | 6085 470    | Ti, Fe           | 2                       |
| 6059 970    |                  | 0000                    | 6085 656    |                  | 0000                    |
| 6060 340    |                  | 0000                    | 6086 128    |                  | 0000                    |
| 6060 853    |                  | 0000                    | 6086 500    | Ni               | 1                       |
| 6061 037    |                  | 0000                    | 6086 885    |                  | 0000 N                  |
| 6061 870    |                  | 000                     | 6088 047    |                  | 00 N                    |
| 6062 455    |                  | 0000 N                  | 6088 490    |                  | 0000 N                  |
| 6062 704    |                  | 0000                    | 6089 275    |                  | 0000 N                  |
| 6062 910    |                  | 000                     | 6089 538    |                  | 0000                    |
| 6063 080    |                  | 0                       | 6089 787    | Fe               | 1                       |

# PRELIMINARY TABLE OF SOLAR SPECTRUM WAVE-LENGTHS XII

By HENRY A ROWLAND

| Wave length  | Substance | Intensity and Character | Wave length  | Substance | Intensity and Character |
|--------------|-----------|-------------------------|--------------|-----------|-------------------------|
| 6090 010     |           | 0000                    | 6105 995     |           | 000                     |
| 6090 186     |           | 0000                    | 6106 651     |           | 0000                    |
| 6090 287     |           | 0000                    | 6106 840     |           | 00                      |
| 6090 429     | Fe        | 2                       | 6107 070     |           | 0000                    |
| 6090 722     |           | 0000 N                  | 6107 309     |           | 0000                    |
| 6091 395     |           | 0                       | 6107 560     |           | 0000                    |
| 6091 580     |           | 0000                    | 6108 108     |           | 0000                    |
| 6091 714     |           | 0000                    | 6108 334 s   | Ni        | 6                       |
| 6091 945     |           | 000                     | 6108 503     |           | 0000                    |
| 6092 133     |           | 1                       | 6108 675     |           | 0000 d?                 |
| 6092 737     |           | 0000                    | 6109 105     |           | 0000                    |
| 6093 030     |           | 000                     | 6109 545     |           | 0000                    |
| 6093 366     |           | 00 N                    | 6110 042     |           | 0000                    |
| 6093 580     | A?        | 0000                    | 6110 555     |           | 0000 d?                 |
| 6093 864     | Fe        | 2                       | 6111 005     |           | 0000                    |
| 6094 075     |           | 0000                    | 6111 290 s   | Ni        | 2                       |
| 6094 590     | Fe        | 1                       | 6111 545     |           | 0000 N                  |
| 6095 118     |           | 0000                    | 6111 872     | V         | 0 d?                    |
| 6095 575     |           | 0000                    | 6112 235     |           | 0000                    |
| 6096 360     |           | 0000 N                  | 6112 500     |           | 0000 N                  |
| 6096 880     | Fe        | 3                       | 6112 621     |           | 0000                    |
| 6097 095     |           | 0000                    | 6113 142     |           | 0                       |
| 6097 312     |           | 0000                    | 6113 340     |           | 0000                    |
| 6097 505     |           | 000                     | 6113 538     |           | 0                       |
| 6098 000     |           | 0000                    | 6114 075     |           | 0000                    |
| 6098 465     |           | 0                       | 6114 600     |           | 0000 N                  |
| 6098 870     |           | 00                      | 6115 010     |           | 0000                    |
| 6099 888     |           | 0000 N                  | 6115 960     |           | 000 N                   |
| 6100 490     |           | 00                      | 6116 268     |           | 0000                    |
| 6102 392 s   | Fe        | 6                       | 6116 397 } s | Ni        | 4                       |
| 6102 635     |           | 0000 Nd?                | 6116 455 }   | Fe        | 1                       |
| 6102 937 s   | Ca        | 9                       | 6116 665     |           | 0000                    |
| 6103 289     |           | 0000                    | 6116 900     |           | 0000 Nd?                |
| 6103 400 } s | Fe        | 4                       | 6117 210     |           | 00                      |
| 6103 514 }   |           | 1                       | 6117 415     |           | 000                     |
| 6103 690     |           | 000                     | 6117 623     |           | 0000                    |
| 6103 796     |           | 0000                    | 6117 846     |           | 0000                    |
| 6104 830     |           | 0000                    | 6118 028     |           | 0000                    |
| 6105 349     |           | 0                       | 6118 139     |           | 0000                    |
| 6105 730     |           | 0000                    | 6118 320     |           | 000                     |

| Wave length | Substance           | Intensity and Character | Wave length | Substance        | Intensity and Character |
|-------------|---------------------|-------------------------|-------------|------------------|-------------------------|
| 6119 385    | V<br>N <sub>1</sub> | 0000                    | 6136 829 s  | Fe               | 8                       |
| 6119 527    |                     | 0000                    | 6137 210    | Fe               | 3                       |
| 6119 740    |                     | I                       | 6137 428    |                  | 0000                    |
| 6119 970    |                     | 0                       | 6137 505    |                  | 000                     |
| 6120 245    |                     | 0000                    | 6137 710    |                  | 000                     |
| 6120 460    |                     | 00                      | 6137 915    | Fe               | 7                       |
| 6120 751    |                     | 0000                    | 6138 266    |                  | 0000 N                  |
| 6121 010    |                     | 0000                    | 6138 725    |                  | 00 N                    |
| 6121 215    |                     | 000                     | 6139 864    |                  | 000 N                   |
| 6121 541    |                     | 0000                    | 6141 020    | -                | 0000                    |
| 6121 986    | Ca                  | 0000                    | 6141 265    |                  | 000                     |
| 6122 434 s  |                     | 10                      | 6141 595    |                  | 0000                    |
| 6122 830    |                     | 000                     | 6141 938 s  | Fe, Ba           | 7                       |
| 6123 468    |                     | 0000                    | 6142 225    |                  | 0000                    |
| 6123 730    |                     | 0000                    | 6142 420    |                  | 0000                    |
| 6124 287    |                     | 0000                    | 6142 700    |                  | 1                       |
| 6124 703    |                     | 0000                    | 6143 044    |                  | 0000 N                  |
| 6125 236    |                     | I                       | 6143 390    |                  | 0000 N                  |
| 6125 522    |                     | 0000                    | 6143 976    |                  | 0000 N                  |
| 6126 075    |                     | 0000 N                  | 6144 550    |                  | 0000                    |
| 6126 435    | Ti                  | I                       | 6144 988    |                  | 0000                    |
| 6126 665    |                     | 0000                    | 6145 228    |                  | 2                       |
| 6127 001    |                     | 0000                    | 6145 616    |                  | 000 N                   |
| 6127 684    |                     | 0000 N                  | 6146 445    |                  | 000                     |
| 6127 851    |                     | 0000                    | 6146 882    |                  | 0000                    |
| 6128 124    | Fe                  | 3                       | 6147 380    |                  | 0000 N                  |
| 6128 320    |                     | 0000                    | 6147 702    |                  | 0000                    |
| 6129 190    |                     | I                       | 6147 950    |                  | 2                       |
| 6129 430    |                     | 000                     | 6148 040    | Fe               | 3                       |
| 6129 740    |                     | 000 N                   | 6148 300    |                  | 0000 N                  |
| 6129 940    |                     | 000                     | 6148 480    |                  | 0000                    |
| 6130 145    |                     | 0000                    | 6148 870    |                  | 000                     |
| 6130 344    | N <sub>1</sub>      | I                       | 6149 209    |                  | 0000                    |
| 6130 560    |                     | 0000                    | 6149 458    | h <sub>2</sub> e | 2                       |
| 6131 181    |                     | 0000 N                  | 6149 766    |                  | 0000                    |
| 6131 490    |                     | 0000 N                  | 6149 950    |                  | 0000 N                  |
| 6131 785    |                     | 0                       | 6150 360    | V                | 0 N d?                  |
| 6132 070    |                     | 0                       | 6150 840    |                  | 0000                    |
| 6132 490    |                     | 0000 N                  | 6151 052    |                  | 0000                    |
| 6132 704    |                     | 0000                    | 6151 550    |                  | 0000                    |
| 6133 020    |                     | 0000 N                  | 6151 834    | Fe               | 4                       |
| 6133 440    |                     | 000 N                   | 6152 054    |                  | 0000                    |
| 6133 785    | V<br>Cr             | 0000 N                  | 6152 226    |                  | 0000                    |
| 6134 175    |                     | 00                      | 6152 520    |                  | 000 N                   |
| 6134 810    |                     | 000 N d?                | 6152 854    |                  | 0000                    |
| 6135 280    |                     | 0000 N                  | 6153 055    |                  | 0000                    |
| 6135 580    |                     | 00 N                    | 6153 560    |                  | 0000 N                  |
| 6135 985    |                     | 00 N                    | 6154 129    |                  | 0000 N                  |
| 6136 280    |                     | 0000                    | 6154 438 s  | Na               | 2                       |
| 6136 500    |                     | 0000                    | 6154 650    |                  | 0000                    |

| Wave-length | Substance | Intensity and Character | Wave length | Substance   | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-------------|-------------------------|
| 6154 898    |           | 0000 N                  | 6173 276    |             | 0000 N                  |
| 6155 101    |           | 0000                    | 6173 553 s  | Fe          | 5                       |
| 6155 350    |           | 7                       | 6173 782    |             | 0000                    |
| 6155 450    |           | 000                     | 6174 065    |             | 0000                    |
| 6155 699    |           | 0000                    | 6174 948    |             | 0000 N                  |
| 6155 918    |           | 000                     | 6175 370    |             | 0000                    |
| 6156 240    |           | 00                      | 6175 584    | Ni          | 3                       |
| 6156 490    |           | 000 N                   | 6175 807    |             | 0000 N                  |
| 6157 010    |           | 000 N                   | 6176 011    |             | 0000                    |
| 6157 450    |           | 0000 N                  | 6176 426    |             | 0000                    |
| 6157 630    |           | 000                     | 6176 669    |             | 0000                    |
| 6157 945    | Fe        | 5                       | 6176 815    |             | 0000                    |
| 6158 130    |           | 0000                    | 6177 027 s  | Ni-         | 5                       |
| 6158 380    |           | 000 N                   | 6177 255    |             | 0000                    |
| 6158 888    |           | 0000                    | 6177 463    |             | 0                       |
| 6159 300    |           | 0000                    | 6177 747    |             | 0000                    |
| 6159 590    |           | 0                       | 6177 977    |             | 0000                    |
| 6159 910    |           | 0000 N                  | 6178 730    |             | 0000 N                  |
| 6160 437    |           | 0000                    | 6179 610    |             | 000                     |
| 6160 660    |           | 0000                    | 6180 279    |             | 0000                    |
| 6160 956 s  | Na        | 3                       | 6180 420 s  | Fe          | 5                       |
| 6161 176    |           | 0000                    | 6180 587    |             | 0000                    |
| 6161 298    |           | 0000                    | 6182 849    |             | 0000                    |
| 6161 503    | Ca        | 4                       | 6183 334    |             | 0000                    |
| 6161 844    |           | 0000 N                  | 6183 779    | , A (wv)?   | 0 Nd?                   |
| 6162 390 s  | Ca        | 15                      | 6184 080    |             | 000                     |
| 6163 630    | Ni        | 2                       | 6185 918    | Fe          | 1                       |
| 6163 765    | Fe        | 1                       | 6186 424    | , A (wv)?   | 00 N                    |
| 6163 968    | Ca        | 3                       | 6186 928    | Ni          | 2                       |
| 6164 777    |           | 0000 N                  | 6187 618    |             | 00                      |
| 6165 378    |           | 0000                    | 6188 210    | Fe          | 4                       |
| 6165 577    | Fe        | 3                       | 6188 679    |             | 0000 Nd?                |
| 6165 760    |           | 0000                    | 6189 200    | Co, A (wv)? | 00 Nd?                  |
| 6166 105    |           | 0000                    | 6189 594    |             | 0000 N                  |
| 6166 266    |           | 0000                    | 6190 611    |             | 000                     |
| 6166 410    |           | 0000                    | 6190 873    |             | 0000                    |
| 6166 651    | Ca        | 5                       | 6191 048    |             | 0000                    |
| 6168 083    |           | 0000 N                  | 6191 393 s  | Ni          | 6                       |
| 6169 002    |           | 0000                    | 6191 779 s  | Fe          | 9                       |
| 6169 249 s  | Ca        | 6                       | 6194 440    |             | 0000                    |
| 6169 529    |           | 0000                    | 6194 633    |             | 0 N                     |
| 6169 778 s  | Ca        | 7                       | 6195 080    |             | 0000                    |
| 6170 178    |           | 000 N                   | 6195 663    |             | 0 N                     |
| 6170 420    | V         | 0000 N                  | 6196 373    |             | 0000                    |
| 6170 730    | Fe-Ni     | 6                       | 6198 107    |             | 0000                    |
| 6171 028    |           | 0000                    | 6198 864    |             | 0000                    |
| 6171 215    |           | 0000                    | 6199 398    | V           | 0                       |
| 6171 443    |           | 0000                    | 6199 718    |             | 00                      |
| 6172 161    |           | 0000                    | 6199 985    |             | 0000                    |
| 6172 945    |           | 0000 N                  | 6200 160    |             | 0000                    |

| Wave length | Substance | Intensity and Character | Wave length  | Substance   | Intensity and Character |
|-------------|-----------|-------------------------|--------------|-------------|-------------------------|
| 6200 527 s  | Fe        | 6                       | 6230 551     |             | 0000                    |
| 6200 690    |           | 0000                    | 6230 943 s   | V Fe        | 8                       |
| 6201 176    |           | 0000                    | 6231 211     |             | 0000                    |
| 6203 554    |           | 0000                    | 6232 856     | Fe          | 3                       |
| 6204 698    |           | 0000                    | 6233 082     |             | 0000                    |
| 6204 825    | Ni        | 1                       | 6233 408     |             | 000                     |
| 6205 360    |           | 0000 N                  | 6233 720     |             | 0000Nd?                 |
| 6207 460    |           | 000                     | 6236 816     |             | 0000 N                  |
| 6207 916    |           | 0000                    | 6237 534 s   |             | 3                       |
| 6208 425    |           | 000                     | 6238 598     | <i>h Fe</i> | 2                       |
| 6208 783    |           | 00                      | 6239 234     |             | 0000                    |
| 6209 100    |           | 0000                    | 6239 585     |             | 00                      |
| 6209 962    |           | 0000 N                  | 6239 980     |             | 0000                    |
| 6210 895    |           | 00 N                    | 6240 165     |             | 00                      |
| 6212 275    |           | 00 N                    | 6240 370     |             | 0000                    |
| 6212 479    |           | 0000                    | 6240 530     |             | 00                      |
| 6213 644 s  | Fe        | 6                       | 6240 863     | Fe          | 3                       |
| 6213 840    |           | 0000                    | 6241 065     |             | 0000                    |
| 6214 080    | V         | 000                     | 6243 055     | V           | 000                     |
| 6214 885    |           | 000 N                   | 6243 320     |             | 1                       |
| 6215 231    |           | 0000                    | 6243 540     |             | 0000 N                  |
| 6215 360    | Fe        | 5                       | 6244 033     |             | 2                       |
| 6215 630    | li        | 000                     | 6244 335     |             | 000 N                   |
| 6215 931    |           | 0000                    | 6244 686     |             | 2                       |
| 6216 103    |           | 00 N                    | 6245 137     |             | 0000 N                  |
| 6216 567    |           | 1                       | 6245 413     |             | 0000 N                  |
| 6216 810    |           | 0000                    | 6245 832     |             | 1                       |
| 6217 900    |           | 000                     | 6246 100     |             | 0000 N                  |
| 6219 494 s  | Fe        | 6                       | 6246 535 s   | Fe          | 8                       |
| 6219 730    |           | 0000                    | 6247 774     | <i>h Fe</i> | 2                       |
| 6220 150    |           | 0000                    | 6249 122     |             | 000                     |
| 6220 450    |           | 000                     | 6249 409     |             | 0000                    |
| 6220 700    |           | 000                     | 6249 710     |             | 0000                    |
| 6221 005    | Fe        | 0                       | 6249 860     |             | 000                     |
| 6221 222    |           | 0000                    | 6251 495     |             | 0000                    |
| 6221 552    | Fe,       | 00 Nd?                  | 6252 048     | V           | 00                      |
| 6221 850    |           | 0000                    | 6252 278     |             | 0000                    |
| 6223 652    |           | 0000 N                  | 6252 410     |             | 0000 Nd                 |
| 6224 198    | Ni?       | 1                       | 6252 773 s   | Fe          | 7                       |
| 6224 407    |           | 0000                    | 6254 050     |             | 00                      |
| 6224 715    | V         | 000                     | 6254 382 } s |             | 1                       |
| 6225 380    |           | 0000 N                  | 6254 456 } s | Fe          | 5                       |
| 6225 700    |           | 0000                    | 6255 000     |             | 0000 N                  |
| 6226 527    |           | 0000 N                  | 6255 805     |             | 0000 N                  |
| 6226 951    | Fe        | 1                       | 6256 168     | Fe          | 00                      |
| 6227 770    |           | 00                      | 6256 572 s   | Ni-Fe       | 6                       |
| 6229 437    | Fe        | 1                       | 6257 090     |             | 0000 N                  |
| 6229 852    |           | 0000                    | 6257 802     |             | 0000 N                  |
| 6230 050    |           | 0000                    | 6258 322     | Ti          | 2                       |
| 6230 312    | Ni        | 0                       | 6258 570     | V           | 000 N                   |

130 TABLE OF SOLAR SPECTRUM WAVE-LENGTHS

| Wave length           | Substance       | Intensity and Character | Wave length           | Substance | Intensity and Character |
|-----------------------|-----------------|-------------------------|-----------------------|-----------|-------------------------|
| 6258 780              |                 | 00                      | 6278 012              |           | 000                     |
| 6258 927              | T <sub>1</sub>  | 3                       | 6278 177              | A(wv)     | 0000                    |
| 6259 144              |                 | 0000                    | 6278 303 <sup>a</sup> | A(O)      | 4 d                     |
| 6259 448              |                 | 0000                    | 6278 579              | A(wv)     | 00 N                    |
| 6259 800              |                 | 00                      | 6278 760              |           | 0000                    |
| 6259 980              |                 | 0000                    | 6278 907              |           | 0000                    |
| 6261 316 s            | T <sub>1</sub>  | 1                       | 6279 084              | A(O)      | 2                       |
| 6261 501              | V               | 0000                    | 6279 308              | A(O)      | 3                       |
| 6261 760              |                 | 0000 N                  | 6279 530              | A(wv),    | 00 Nd?                  |
| 6262 173              |                 | 0000                    | 6279 754              | A(wv)     | 0000                    |
| 6262 458              |                 | 0000 N                  | 6279 946              |           | 0 d                     |
| 6263 164              |                 | 0000 N                  | 6280 108              | A(O)      | 2                       |
| 6265 015              |                 | 0000                    | 6280 305              |           | 0000                    |
| 6265 348 s            | Fe              | 5                       | 6280 460              |           | 0000                    |
| 6265 573              |                 | 0000                    | 6280 598              | A(O)      | 2                       |
| 6265 820              |                 | 000                     | 6280 833              | Fe        | 3 d                     |
| 6266 223              |                 | 0000 N                  | 6281 025              |           | 0000                    |
| 6266 550              |                 | 000                     | 6281 228              | *         | 0000                    |
| 6267 042              |                 | 0000                    | 6281 387              | A(O)      | 1                       |
| 6267 424              |                 | 0000 N                  | 6281 575              |           | 0000                    |
| 6267-860              | , A (wv)        | 000                     | 6281 835              |           | 000 N                   |
| 6268 040              |                 | 000                     | 6282 004              |           | 0000                    |
| 6268 433              |                 | 0000                    | 6282 164              | A(O)      | 2                       |
| 6268 819              |                 | 0000                    | 6282 350              | A?        | 0000                    |
| 6269 080              | V               | 000 N                   | 6282 502              |           | 0000                    |
| 6269 630              |                 | 0000                    | 6282 740              | A(wv)     | 000                     |
| 6270 200              |                 | 000                     | 6282 808              |           | 000                     |
| 6270 442              | Fe              | 3                       | 6282 933              | Co A (O)  | 2                       |
| 6270 628              |                 | 0000                    | 6283 035              |           | 000                     |
| 6271 112              |                 | 0000 N                  | 6284 002              | A(O)      | 1                       |
| 6271 486              | Fe <sup>-</sup> | 0                       | 6284 210              |           | 0000                    |
| 6271 703              |                 | 0000                    | 6284 748              | A(O)      | 0                       |
| 6271 970              |                 | 000                     | 6284 993              |           | 0000                    |
| 6272 157              | A(wv)           | 0000                    | 6285 384              | V         | 00 N                    |
| 6272 623              | A(wv)           | 000                     | 6285 878              |           | 0000 N                  |
| 6272 870              |                 | 000                     | 6286 031              | A(wv)     | 00                      |
| 6273 306              |                 | 0000 N                  | 6286 359              |           | 0                       |
| 6274 170              |                 | 000 N                   | 6287 009              |           | 0000 N                  |
| 6274 870              |                 | 00                      | 6287 494              |           | 000 N                   |
| 6275 478              | A(wv)           | 000                     | 6287 953 <sup>3</sup> | A(O)      | 1                       |
| 6276 450              |                 | 0000 N                  | 6288 154              | A(wv)?    | 000 N                   |
| 6276 690              |                 | 0000                    | 6288 530              |           | 000 Nd?                 |
| 6276-815 <sup>2</sup> | A(O)            | 2 d                     | 6288 839              |           | 0000                    |
| 6277 021              | A(O)            | 1                       | 6288 955              |           | 0000                    |
| 6277 164              | A?              | 00 N                    | 6289 384              | A(wv)?    | 000                     |
| 6277 359              | A?              | 000                     | 6289 606              | A(O)      | 1                       |
| 6277 513              | A(O)            | 2                       | 6289 790              |           | 0000                    |
| 6277 639              | A(O)            | 1                       | 6290 106              |           | 0000 N                  |
| 6277 701              | A(O)            | 1                       | 6290 427              | A(O)      | 2                       |
| 6277 837              | A(O)            | 1                       | 6290 750              |           | 000 N                   |

<sup>1</sup> First line in the head of the alpha group, due to atmospheric oxygen<sup>2</sup> Principal line in the head of the alpha group<sup>3</sup> First line in the tail of the alpha group

| Wave length | Substance | Intensity and Character | Wave length | Substance      | Intensity and Character |
|-------------|-----------|-------------------------|-------------|----------------|-------------------------|
| 6291 184    | Fe        | 4                       | 6308 090    |                | 000 N                   |
| 6292 373    | A (O)     | 2                       | 6309 040    |                | 000 N                   |
| 6292 572    |           | 0000                    | 6310 101    | A (O)          | 2                       |
| 6292 825    | A (wv)    | 0000 N                  | 6310 487    |                | 00 Nd?                  |
| 6293 030    | V         | 000                     | 6310 698    |                | 0000                    |
| 6293 170    | A (O)     | 3                       | 6310 848    | A (O)          | 1                       |
| 6293 370    |           | 0000                    | 6311 055    |                | 0000                    |
| 6294 155    |           | 00 Nd?                  | 6311 451    |                | 00 Nd?                  |
| 6294 875    | A (wv)    | 0000 N                  | 6311 722    | Fe             | 1                       |
| 6295 242    |           | 0000                    | 6311 936    |                | 0000 N                  |
| 6295 389    | A (O)     | 3                       | 6312 456    |                | 00 N                    |
| 6295 590    |           | 0000                    | 6312 980    |                | 000                     |
| 6295 860    | A (wv)    | 0000 N                  | 6314 077    |                | 0000 N                  |
| 6296 022    |           | 0000                    | 6314 449    | A (O)          | 0                       |
| 6296 170    | A (O)     | 3                       | 6314 876    | N <sub>1</sub> | 4                       |
| 6296 360    |           | 0000                    | 6315 189    | A (O)          | 0                       |
| 6296 582    | V         | 0000                    | 6315 517    | Fe             | 2                       |
| 6296 715    |           | 0000                    | 6315 631    |                | 00                      |
| 6297 471    | A (wv)?   | 0000                    | 6315 854    |                | 0000                    |
| 6297 517    |           | 0000                    | 6316 028    | Fe             | 1                       |
| 6298 007    | Fe        | 5                       | 6316 245    |                | 0000                    |
| 6298 295    |           | 0000                    | 6316 510    | A (wv)         | 0000 N                  |
| 6298 513    |           | 0000                    | 6316 816    |                | 0000                    |
| 6298 666    | Co, A (O) | 2                       | 6317 440    | A (wv)         | 0000 N                  |
| 6298 854    |           | 0000                    | 6317 670    |                | 0000                    |
| 6299 436    | Fe, A (O) | 3                       | 6318 239    | Fe             | 6                       |
| 6299 625    | A (wv)    | 000                     | 6318 524    |                | 0000 N                  |
| 6299 805    |           | 0                       | 6318 919    |                | 1                       |
| 6300 535    |           | 000                     | 6319 082    | A (O)          | 0                       |
| 6300 904    |           | 000                     | 6319 274    |                | 0000                    |
| 6301 718    | Fe        | 7                       | 6319 460    |                | 0                       |
| 6302 056    |           | 0000                    | 6319 690    | , (wv)?        | 000                     |
| 6302 209    | A (O)     | 2                       | 6319 806    | A (O)          | 0                       |
| 6302 401    |           | 0000                    | 6320 250    | A (wv)         | 0000 N                  |
| 6302 709    | Fe        | 5                       | 6320 660    |                | 000                     |
| 6302 975    | A (O)     | 2                       | 6321 070    |                | 00                      |
| 6303 159    |           | 0000                    | 6321 505    | A (wv)         | 0000                    |
| 6303 700    |           | 000 N                   | 6322 380    | N <sub>1</sub> | 0                       |
| 6303 985    |           | 000 N                   | 6322 550    |                | 0000                    |
| 6304 545    |           | 000 N                   | 6322 907    | Fe             | 4                       |
| 6305 070    |           | 0000 N                  | 6323 244    |                | 0000 N                  |
| 6305 525    |           | 000 N                   | 6323 688    |                | 0000 N                  |
| 6305 878    |           | 0000                    | 6323 957    | A (O)          | 00                      |
| 6306 024    | A (O)     | 2                       | 6324 096    | A (wv)         | 0000                    |
| 6306 201    |           | 0000                    | 6324 709    | A (O)          | 00                      |
| 6306 430    |           | 0000                    | 6324 894    |                | 0000                    |
| 6306 619    |           | 0000                    | 6325 382    |                | 0000                    |
| 6306 780    | A (O)     | 2                       | 6325 748    |                | 0000 N                  |
| 6306 950    |           | 0000                    | 6327 038    |                | 0000                    |
| 6307 763    |           | 0000 N                  | 6327 485    |                | 0000                    |

# PRELIMINARY TABLE OF SOLAR SPECTRUM WAVE-LENGTHS XIII

By HENRY A ROWLAND

| Wave length | Substance    | Intensity<br>and<br>Character | Wave length | Substance | Intensity<br>and<br>Character |
|-------------|--------------|-------------------------------|-------------|-----------|-------------------------------|
| 6327 820    | Ni           | 2                             | 6361 031    | Ni        | 0                             |
| 6327 997    |              | 0000                          | 6361 415    |           | 0000 N                        |
| 6329 142    | A (O)        | 000                           | 6362 560    | /n        | 1                             |
| 6329 855    | A (O)        | 000                           | 6363 090    | Cl, Fe    | 2                             |
| 6330 316    | Cr           | 1                             | 6364 575    | Fe        | 1                             |
| 6331 067    | Fe           | 2                             | 6364 920    |           | 0                             |
| 6331 345    |              | 0000                          | 6366 564    | Li        | 000                           |
| 6331 619    |              | 0000                          | 6366 707    | Ni        | 0                             |
| 6332 180    |              | 0 N                           | 6366 982    |           | 0000                          |
| 6333 460    | A (wv)       | 0000                          | 6367 350    |           | 000                           |
| 6334 588    | A (O), (wv?) | 0000                          | 6367 640    |           | 000                           |
| 6334 903    |              | 0000                          | 6369 244    |           | 0000                          |
| 6335 307    | A (O)        | 0000                          | 6369 683    | Fe        | 0                             |
| 6335 554    | Fe           | 6                             | 6370 574    | Ni        | 00                            |
| 6336 032    | A (wv)?      | 0000                          | 6371 573    | Fe        | 1 N d?                        |
| 6336 329    | Li           | 000 N                         | 6375 455    |           | 0000                          |
| 6336 665    | A?           | 0000                          | 6376 033    |           | 000                           |
| 6337 048    | Fe           | 7                             | 6376 385    |           | 0000                          |
| 6339 096    | Fe           | 2                             | 6378 468    | Ni        | 2                             |
| 6339 335    | Ni           | 2                             | 6378 877    |           | 0000                          |
| 6339 520    |              | 0000                          | 6379 165    |           | 0000                          |
| 6340 190    |              | 0000                          | 6379 878    |           | 0000                          |
| 6342 603    | A (wv)       | 0000                          | 6380 958    | Fe        | 4                             |
| 6344 030    |              | 0000                          | 6381 359    |           | 0000                          |
| 6344 371    | Fe           | 4                             | 6381 844    |           | 0000                          |
| 6347 310    |              | 2 N                           | 6383 932    |           | 0 N                           |
| 6347 572    |              | 0000 N                        | 6384 119    |           | 0000                          |
| 6348 080    |              | 000                           | 6384 886    | Ni        | 1                             |
| 6350 709    |              | 000                           | 6385 303    |           | 0000 N                        |
| 6350 920    | A (wv)       | 0000                          | 6385 680    | Mn?       | 000 N                         |
| 6351 510    |              | 0000                          | 6385 950    |           | 0                             |
| 6352 728    |              | 0000                          | 6388 630    |           | 000                           |
| 6353 160    |              | 0000                          | 6389 502    |           | 0000                          |
| 6353 602    |              | 0000                          | 6390 715    |           | 000                           |
| 6354 060    |              | 0000                          | 6391 472    |           | 0000 N                        |
| 6354 868    |              | 0000                          | 6392 751    |           | 0                             |
| 6355 246    | Fe           | 4                             | 6393 820 s  | Fe        | 7                             |
| 6355 410    |              | 00                            | 6394 417    |           | 000 N                         |
| 6358 898    | Fe           | 6                             | 6394 700    |           | 0000 N                        |
| 6359 437    |              | 0000                          | 6395 378    |           | 00 N d?                       |



TABLE OF SOLAR SPECTRUM WAVE-LENGTHS 133

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 6396 038    |           | 0000                    | 6428 385    |           | 0000                    |
| 6396 600    |           | 0000 N                  | 6428 843    |           | 0000                    |
| 6397 757    |           | 0000                    | 6430 130    |           | 000                     |
| 6398 205    |           | 000 N                   | 6430 485    |           | 0000                    |
| 6399 129    |           | 0000 N                  | 6430 665    |           | 0000                    |
| 6400 100    |           | 000                     | 6431 066 s  | Fe        | 5                       |
| 6400 217 s  | Fe        | 8                       | 6431 466    |           | 0000                    |
| 6400 538 s  | Fe        | 2                       | 6431 890    |           | 0000                    |
| 6401 023    |           | 0000 N                  | 6432 240    |           | 000 N                   |
| 6401 296    |           | 0000 N                  | 6432 529    |           | 0000                    |
| 6401 714    |           | 0000                    | 6432 895    | Fe?       | 1                       |
| 6402 507    |           | 0000 N                  | 6433 110    | A         | 0000                    |
| 6403 345    |           | 000 N                   | 6433 665    | Fe?       | 0 N                     |
| 6403 910    |           | 0000 N                  | 6433 948    |           | 0000                    |
| 6404 392    |           | 0000 N                  | 6434 706    | A         | 0000                    |
| 6405 980    |           | 00 N d?                 | 6435 260    |           | 0000                    |
| 6406 590    |           | 0000 N                  | 6436 267    |           | 0000                    |
| 6407 350    |           | 0000 N                  | 6436 630    | Fe?       | 0                       |
| 6407 515    |           | 0 N                     | 6437 136    |           | 0000 N                  |
| 6408 233 s  | Fe        | 5                       | 6437 930    |           | 000 N                   |
| 6408 587    |           | 0000                    | 6438 251    |           | 0000 N                  |
| 6408 910    | Si?       | 000                     | 6438 995    |           | 000                     |
| 6409 497    |           | 0000                    | 6439 293 s  | Ca *      | 8                       |
| 6410 643    |           | 0000                    | 6439 786    |           | 0000                    |
| 6411 145    |           | 00                      | 6440 326    |           | 0000                    |
| 6411 330    |           | 000                     | 6440 865    |           | 0000                    |
| 6411 865 s  | Fe        | 7                       | 6441 158    | Mn?       | 000                     |
| 6412 445    |           | 0000                    | 6441 835    |           | 0000                    |
| 6413 800    |           | 0000 N                  | 6442 693    |           | 0000 N                  |
| 6414 147    |           | 0000                    | 6443 180    |           | 000                     |
| 6414 813    | Ni        | 0                       | 6443 700    |           | 0000 N                  |
| 6415 199    |           | 1 N                     | 6444 430    |           | 0000 N                  |
| 6415 635    |           | 0000 N                  | 6444 880    |           | 0000                    |
| 6416 242    |           | 0000                    | 6446 345    |           | 0000 N                  |
| 6416 741    |           | 0000                    | 6446 620    |           | 0000                    |
| 6417 133    | Fe?       | 1                       | 6448 170    |           | 0000 N                  |
| 6417 427    |           | 0000                    | 6449 355    |           | 0 N d?                  |
| 6417 900    | Co        | 00 N                    | 6449 650    |           | 0000 N                  |
| 6418 095    |           | 0000                    | 6450 033 s  | Ca        | 6                       |
| 6419 585    |           | 0000                    | 6450 396    | Co        | 0                       |
| 6419 880    |           | 000                     | 6450 552    | Co        | 0                       |
| 6420 169 s  | Fe        | 4                       | 6450 866    |           | 0000                    |
| 6420 820    |           | 0000                    | 6451 785    |           | 000 N                   |
| 6421 022    |           | 0000                    | 6452 536    |           | 00 N                    |
| 6421 570 s  | Fe        | 7                       | 6452 900    |           | 0000 N                  |
| 6421 740    | Ni        | 000                     | 6453 815    |           | 0000 N                  |
| 6425 080    |           | 00                      | 6454 350    | A         | 0000 N                  |
| 6425 748    |           | 0000                    | 6455 230    | Co        | 0 N                     |
| 6426 510    |           | 000 N                   | 6455 485    |           | 0000 N                  |
| 6426 900    |           | 0000 N                  | 6455 820    | Ca        | 2                       |

| Wave length  | Substance | Intensity and Character | Wave length | Substance      | Intensity and Character |
|--------------|-----------|-------------------------|-------------|----------------|-------------------------|
| 6456 070     |           | 0000                    | 6474 330    | A (wv)         | 000 N                   |
| 6456 238     |           | 0000                    | 6474 830    | A?             | 0000 N                  |
| 6456 603     | <i>12</i> | 3                       | 6475 280    | A (wv)         | 00                      |
| 6456 872     |           | 0000                    | 6475 435    | A (wv)         | 00                      |
| 6457 080     |           | 00 N                    | 6475 846    |                | 2                       |
| 6457 335     | A?        | 0000                    | 6476 046    | A (wv)         | 0                       |
| 6457 595     |           | 000                     | 6476 584    |                | 0000                    |
| 6458 770     |           | 0000                    | 6476 795    |                | 0000                    |
| 6459 115     | A         | 000                     | 6477 240    |                | 0000                    |
| 6459 300     | A         | 0000                    | 6477 550    | A (wv)         | 0000 d                  |
| 6459 904     | A         | 0000                    | 6478 110    |                | 000 N                   |
| 6460 210     | A         | 0000                    | 6479 408    | A (wv)         | 00                      |
| 6460 440     | A         | 0000                    | 6479 715    | A (wv)         | 000                     |
| 6461 154     | A?        | 0000                    | 6480 285 s  | A (wv)         | 1                       |
| 6461 345     |           | 0000                    | 6480 475    | A (wv)         | 0000                    |
| 6462 060     | A         | 0000                    | 6481 220    | A (wv)         | 000 N                   |
| 6462 260     | A         | 0000                    | 6481 910    | A (wv)         | 0000                    |
| 6462 784 } s | Ca        | 5                       | 6482 098    |                | 3                       |
| 6462 965 } s | Fe        | 3                       | 6482 410    |                | 000                     |
| 6463 188     |           | 0000                    | 6482 690    |                | 0000                    |
| 6463 334     | A?        | 0000                    | 6483 027    | N <sub>1</sub> | 1                       |
| 6463 475     |           | 0000                    | 6483 286    | A (wv)         | 0000                    |
| 6463 715     | A (wv)    | 000                     | 6483 468    | A (wv)         | 1                       |
| 6463 965     | A?        | 0000                    | 6483 677    | A (wv)         | 0000                    |
| 6464 170     |           | 0000                    | 6483 975    | A (wv)         | 0000 N                  |
| 6464 398     |           | 0000                    | 6484 170    | A (wv)         | 00 N                    |
| 6464 650     | A (wv)    | 000                     | 6484 694    | A (wv)         | 0000                    |
| 6464 897     |           | 00                      | 6484 900    | A (wv)         | 000                     |
| 6465 630     | A?        | 0000                    | 6485 120    | A (wv)         | 0000                    |
| 6466 002     |           | 0000                    | 6485 360    |                | 0000 N                  |
| 6466 490     | A         | 000 N                   | 6485 790    | A (wv)         | 00                      |
| 6466 960     | A         | 000 N                   | 6486 495    |                | 0000 N                  |
| 6467 212     |           | 0000                    | 6487 005    | A (wv)         | 0                       |
| 6467 823     | A         | 0000 N                  | 6487 515    | A?             | 0000                    |
| 6468 120     | A         | 000                     | 6487 755    | A?             | 0000                    |
| 6468 590     | A?        | 0000                    | 6488 250    | A (wv)         | 000 N                   |
| 6469 050     |           | 0000                    | 6489 350    | A (wv)         | 00                      |
| 6469 408     |           | 2                       | 6489 870    |                | 0000 N                  |
| 6469 593     | A (wv)    | 0000                    | 6490 595    |                | 0000 N                  |
| 6469 860     | A (wv)    | 000 N                   | 6490 877    | A (wv)         | 0000                    |
| 6470 210     | A (wv)    | 000 N                   | 6491 015    | A (wv)         | 1                       |
| 6470 794     |           | 0000 N                  | 6491 465    |                | 0000 N                  |
| 6471 118     |           | 0000 N                  | 6491 800    |                | 1                       |
| 6471 522     |           | 0000                    | 6491 876    | Mn             | 000                     |
| 6471 885 s   | Ca        | 5                       | 6493 130    | A (wv)         | 0                       |
| 6472 360     |           | 0000 N                  | 6493 480    | A (wv)         | 000                     |
| 6472 700     | A (wv)    | 00                      | 6494 004 s  | Ca             | 6                       |
| 6472 823     | A?        | 0000                    | 6494 273    |                | 0000                    |
| 6473 405     | A (wv)    | 00                      | 6494 530    | A?             | 0000                    |
| 6473 744     |           | 0000 N                  | 6494 725    | A (wv)         | 1                       |

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 6495 213 s  | Fe        | 8                       | 6517 925    |           | 0000                    |
| 6495 962    |           | 1                       | 6518 245    | A (wv)    | 00                      |
| 6496 082    | A (wv)    | 2                       | 6518 599 s  | Fe?       | 2                       |
| 6496 340    |           | 0000                    | 6518 973    |           | 0 N                     |
| 6496 688    | Fe        | 2                       | 6519 410    | A (wv)    | 00 N                    |
| 6497 128    | Fe        | 4                       | 6519 682    | A (wv)    | 1 N                     |
| 6497 840    | A (wv)    | 00 N d?                 | 6520 350    |           | 0000 N                  |
| 6498 407    |           | 0000 N                  | 6520 983    |           | 0000 N                  |
| 6498 654    |           | 0000                    | 6522 123    | A (wv)    | 0000                    |
| 6499 168    | Fe        | 1                       | 6522 430    | A (wv)    | 0000                    |
| 6499 437    |           | 000 N                   | 6523 145    |           | 0000 N                  |
| 6499 880 s  | Ca        | 4                       | 6523 580    | A (wv)    | 0000                    |
| 6500 122    |           | 0000                    | 6523 907    | A (wv)    | 0000                    |
| 6500 353    |           | 0000                    | 6524 080    | A (wv)    | 1                       |
| 6501 060    |           | 0000                    | 6524 968    |           | 0000                    |
| 6501 440    |           | 000 N                   | 6526 040    | A (wv)    | 0000                    |
| 6501 901    |           | 0                       | 6526 655    |           | 0000                    |
| 6502 425    |           | 0000 N                  | 6526 888    |           | 0                       |
| 6502 747    | A         | 0000                    | 6527 444    |           | 1                       |
| 6503 114    | A         | 0000                    | 6527 825    |           | 0000 N                  |
| 6503 840    | A?        | 0000 N                  | 6528 340    |           | 0000 N                  |
| 6504 415    | A (wv),-  | 0                       | 6528 777    |           | 00                      |
| 6504 700    |           | 0000                    | 6529 415    |           | 0000 N                  |
| 6505 053    |           | 0000 N                  | 6530 247    |           | 0000                    |
| 6505 710    |           | 0000 N                  | 6530 845    | A (wv)    | 00                      |
| 6506 560    |           | 0000 N                  | 6531 311    |           | 0000                    |
| 6507 340    |           | 0000 N                  | 6531 667    |           | 000                     |
| 6507 800    | A (wv)    | 0000 N                  | 6532 595 s  | A (wv)    | 1                       |
| 6508 380    |           | 0000                    | 6532 800    |           | 0000                    |
| 6508 826    | A (wv)    | 0                       | 6533 110    | Ni?       | 0                       |
| 6509 080    |           | 00                      | 6533 330    |           | 0000                    |
| 6509 845    |           | 000                     | 6533 763    |           | 0000 N                  |
| 6510 410    |           | 0000 N                  | 6534 172 s  | ,A (wv)   | 2                       |
| 6511 679    |           | 0000                    | 6534 470    |           | 0000                    |
| 6512 240    | A (wv)    | 00                      | 6534 875    | A (wv)    | 0000                    |
| 6512 470    | A (wv)    | 00                      | 6535 210    |           | 0000                    |
| 6513 145    | A?        | 0000                    | 6536 212    |           | 0000                    |
| 6513 300    |           | 0000                    | 6536 955    | A (wv)    | 00                      |
| 6513 847    | A         | 0000 N                  | 6537 480    |           | 0000                    |
| 6514 185    | A?        | 0000                    | 6537 666    |           | 0000                    |
| 6514 530    | A (wv)    | 000 N                   | 6538 170    |           | 000 Nd?                 |
| 6514 956    | A (wv),-  | 2                       | 6538 770    | A?        | 000 Nd?                 |
| 6515 456    |           | 0000                    | 6540 665    | A?        | 000 N                   |
| 6516 080    | A (wv)    | 000                     | 6541 510    | A?        | 0000                    |
| 6516 311 s  | h 2e      | 2                       | 6542 550    | A (wv)    | 00                      |
| 6516 634    |           | 0000                    | 6543 280    | A?        | 0000 N                  |
| 6516 750    | A (wv)    | 1                       | 6544 140    | A (wv)    | 2                       |
| 6516 855    | A (wv)    | 2                       | 6546 030    | A (wv)    | 000 N                   |
| 6517 315    | A (wv)    | 0                       | 6546 479 s  | Ti-Fe     | 6                       |
| 6517 657    |           | 0000                    | 6547 945    | A (wv)    | 0                       |

| Wave length               | Substance  | Intensity and Character | Wave length | Substance | Intensity and Character |
|---------------------------|------------|-------------------------|-------------|-----------|-------------------------|
| 6548 855                  | A (wv)     | 1                       | 6583 787    | A (wv)    | 0000                    |
| 6549 290                  | A?         | 0000                    | 6583 967    |           | 00                      |
| 6550 515                  | A?         | 0000                    | 6584 550    | A?        | 0000                    |
| 6551 940                  |            | 000                     | 6584 797    | A?        | 000                     |
| 6552 275                  |            | 0000 N                  | 6585 470    | A (wv)    | 0000 N                  |
| 6552 865 s                | A (wv)     | 1                       | 6585 763    | A?        | 000                     |
| 6554 025                  | A (wv)     | 00 Nd?                  | 6585 950    |           | 0000                    |
| 6554 470                  | 11         | 0                       | 6586 550    | N1        | 1                       |
| 6555 080                  |            | 0000 N                  | 6586 764    | A (wv)    | 000                     |
| 6555 700                  |            | 1 N                     | 6586 935    | A (wv)    | 0000                    |
| 6556 087                  |            | 0000                    | 6587 864    |           | 00 N                    |
| 6556 308                  | 11, A (wv) | 1                       | 6588 828    | A (wv)    | 0000 N                  |
| 6556 558                  |            | 0000                    | 6590 245    |           | 0000 N                  |
| 6557 046                  | Fe?        | 0                       | 6591 575    | Fe?       | 00                      |
| 6557 408                  | A (wv)     | 0                       | 6591 833    |           | 0000                    |
| 6558 095                  | A?         | 0000                    | 6592 076    |           | 0000                    |
| 6558 392                  | A (wv)     | 00 N                    | 6592 372    |           | 0000                    |
| 6558 830                  | A?         | 0000 N                  | 6592 770    | N1        | 00                      |
| 6559 193                  |            | 0000                    | 6593 161 s  | Fe        | 6                       |
| 6559 815                  |            | 0                       | 6594 121 s  | Fe        | 4                       |
| 6560 045                  |            | 0000                    | 6594 600    | A (wv)    | 000                     |
| 6560 307                  |            | 0000                    | 6595 590    |           | 0000                    |
| 6560 490                  |            | 0000                    | 6596 135    |           | 000 N                   |
| 6560 800                  | A (wv)-    | 1 Nd?                   | 6597 273    |           | 0000 N                  |
| 6561 135                  |            | 000                     | 6597 807    | Cr        | 1                       |
| 6563 045 s C <sup>1</sup> | H          | 40                      | 6598 552    |           | 0000 N                  |
| 6563 763                  | A (wv)     | 000                     | 6598 848    | Fe?       | 0                       |
| 6564 305                  | A (wv)     | 00                      | 6599 131    |           | 0000                    |
| 6564 450                  | A (wv)     | 0                       | 6599 353    | Ti        | 00                      |
| 6565 083                  | A?         | 0000 N                  | 6599 570    | A (wv)    | 000                     |
| 6565 783                  | A?         | 000                     | 6599 925    |           | 0000                    |
| 6566 075                  | A?         | 0000                    | 6602 370    | A (wv)    | 0000 Nd?                |
| 6569 040                  | A (wv)     | 000 N                   | 6603 601    |           | 0000 N                  |
| 6569 460 s                | Fe         | 5                       | 6604 837    |           | 1                       |
| 6570 103                  |            | 0000 N                  | 6605 810    |           | 000                     |
| 6570 965                  |            | 0000 Nd?                | 6606 160    |           | 000 N                   |
| 6571 436                  |            | 0000                    | 6607 215    |           | 00 N                    |
| 6572 330 s                | A (wv)     | 1                       | 6607 586    |           | 0000 N                  |
| 6573 030                  | Ca?        | 1                       | 6608 280    |           | 0                       |
| 6573 765                  |            | 0000 N                  | 6609 360 s  |           | 3                       |
| 6574 468 s                |            | 1                       | 6609 818    |           | 00                      |
| 6574 707                  |            | 0000                    | 6609 929    |           | 000                     |
| 6575 085 } s              | A (wv)     | 1                       | 6610 315    |           | 0000                    |
| 6575 270 } s              | Fe         | 2                       | 6610 990    |           | 0000                    |
| 6576 615                  |            | 000 Nd?                 | 6611 612    |           | 0000                    |
| 6577 131                  |            | 0000                    | 6612 474    |           | 000                     |
| 6580 470                  | A (wv),    | 00 N                    | 6612 790    |           | 0000                    |
| 6581 025                  | A (wv)     | 00                      | 6613 675    |           | 00 N                    |
| 6581 452                  |            | 0                       | 6614 045    | N1        | 00 Nd?                  |
| 6583 505                  | A?         | 0000                    | 6617 267    |           | 000 Nd?                 |

<sup>1</sup>The width of C is 0.963, and that of the extreme shading is 1.240. C is either faintly double or reversed in the Sun.

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 6617 980    |           | 000 N                   | 6657 205    |           | 000 N                   |
| 6618 586    |           | 0000 N                  | 6657 878    |           | 000                     |
| 6619 825    |           | 000 N                   | 6659 164    |           | 0000                    |
| 6621 441    |           | 0000 N                  | 6660 105    |           | 000                     |
| 6622 639    |           | 0000 N                  | 6660 830    |           | 0000                    |
| 6624 161    |           | 0000 N                  | 6661 320    | Cr        | 00                      |
| 6624 605    |           | 0000 N                  | 6661 580    |           | 000                     |
| 6625 077    |           | 0000 N                  | 6662 011    |           | 0000 N                  |
| 6625 276    |           | 0                       | 6662 819    |           | 0000 N                  |
| 6626 504    |           | 0000                    | 6663 487 s  |           | 1                       |
| 6627 797    | Fe?       | 0                       | 6663 701 s  | Fe        | 3                       |
| 6628 402    |           | 000 N                   | 6664 030    |           | 0000 N                  |
| 6629 210    |           | 000 N                   | 6664 550    |           | 0000 N                  |
| 6629 628    |           | 0000                    | 6665 420    |           | 000 N                   |
| 6629 924    |           | 0000                    | 6665 998    |           | 0000                    |
| 6630 270    | Cr        | 000                     | 6666 780    |           | 000 N                   |
| 6631 325    |           | 000 N                   | 6667 695    |           | 000                     |
| 6632 011    |           | 0000                    | 6667 980    | Fe?       | 00                      |
| 6632 267    |           | 000                     | 6668 640    |           | 000 N                   |
| 6632 710    |           | 00 N                    | 6669 041    |           | 0000 N                  |
| 6633 665    |           | 0                       | 6669 550    |           | 000 N                   |
| 6633 995 s  | Fe        | 2                       | 6672 915    |           | 0000                    |
| 6634 361    |           | 0                       | 6678 235 s  | Fe        | 5                       |
| 6635 001    |           | 0000 N                  | 6678 817    |           | 0000                    |
| 6635 375    | Ni        | 0 N                     | 6679 090    |           | 000 N                   |
| 6635 636    |           | 0000                    | 6680 396    |           | 000                     |
| 6635 940    |           | 00 N                    | 6680 864    |           | 0000                    |
| 6636 570    |           | 0000 N                  | 6685 131    |           | 0000                    |
| 6638 314    |           | 0000                    | 6687 750    |           | 0000                    |
| 6639 505    |           | 0000 N                  | 6691 067    |           | 000 N                   |
| 6639 955    |           | 0                       | 6692 547    |           | 000 N                   |
| 6640 135    |           | 00 N                    | 6693 099    |           | 000 N                   |
| 6642 510    |           | 0000 N                  | 6695 886    |           | 0000 N                  |
| 6643 457    |           | 0000 Nd?                | 6696 275    |           | 1 N                     |
| 6643 876 s  | Ni        | 5                       | 6696 565    |           | 00                      |
| 6644 102    |           | 0000                    | 6697 070    |           | 0000                    |
| 6644 520    |           | 000 N                   | 6697 650    |           | 000 N                   |
| 6645 365    |           | 000 N                   | 6698 336    |           | 0000 N                  |
| 6646 309    |           | 0000                    | 6698 913    |           | 0                       |
| 6647 205    |           | 00                      | 6699 380    |           | 00                      |
| 6648 095    |           | 0000                    | 6701 163    |           | 0000                    |
| 6648 360    |           | 000                     | 6701 621    |           | 000                     |
| 6648 930    |           | 0000                    | 6703 820 s  |           | 1                       |
| 6651 371    |           | 0000                    | 6704 286    |           | 0000 N                  |
| 6652 600    |           | 0000 N                  | 6704 745    |           | 000                     |
| 6653 215    |           | 0000                    | 6705 352 s  |           | 1                       |
| 6654 150    |           | 00                      | 6705 753    |           | 0000                    |
| 6654 660    |           | 0000                    | 6705 942    |           | 0000                    |
| 6655 770    |           | 000 N                   | 6707 695    |           | 000                     |
| 6656 620    |           | 0000                    | 6708 176    |           | 0000                    |

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 6709 226    |           | 0000 N                  | 6743 826    |           | 000 N                   |
| 6710 182    |           | 0000 N                  | 6745 364    |           | 00                      |
| 6710 570    |           | 0                       | 6745 798    |           | 000 N                   |
| 6710 789    |           | 0000                    | 6746 235    |           | 00                      |
| 6711 529    |           | 0000                    | 6747 226    |           | 000                     |
| 6712 094    |           | 000 N                   | 6747 812    |           | 0000 N                  |
| 6712 714    |           | 000 N                   | 6748 390    |           | 000                     |
| 6713 290    |           | 1                       | 6748 686    |           | 0000                    |
| 6713 454    |           | 000                     | 6749 029    |           | 000                     |
| 6713 993    |           | 1                       | 6749 120    |           | 000                     |
| 6715 635    |           | 1                       | 6749 791    |           | 0000 N                  |
| 6716 500    |           | 0                       | 6750 033    |           | 0000 N                  |
| 6716 914    |           | 000 N                   | 6750 407 s  | Fe        | 3                       |
| 6717 775    |           | 000                     | 6751 690    |           | 0000                    |
| 6717 940 s  | Ca        | 5                       | 6752 965 s  | Fe        | 1                       |
| 6719 880    |           | 000 N                   | 6753 265    |           | 000 N                   |
| 6721 020    |           | 0000 N                  | 6753 720    |           | 000 N                   |
| 6722 096 s  |           | 2                       | 6754 233    |           | 0000                    |
| 6722 959    |           | 0000 N                  | 6755 189    |           | 000                     |
| 6724 935    |           | 000 N                   | 6755 855    |           | 0                       |
| 6725 219    |           | 0000                    | 6756 818    |           | 000 N                   |
| 6725 615    | Fe        | 0                       | 6757 445    |           | 00 Nd?                  |
| 6725 960    |           | 0000                    | 6757 909    |           | 0000 N                  |
| 6726 539    |           | 0000                    | 6759 146    |           | 000 Nd?                 |
| 6726 925 s  | Fe        | 2                       | 6761 260    |           | 000 Nd?                 |
| 6728 922    |           | 0000                    | 6761 852    |           | 0000 Nd?                |
| 6729 270    |           | 00                      | 6762 405    |           | 0000 N                  |
| 6729 996    |           | 000 N                   | 6762 647    |           | 000                     |
| 6730 558    |           | 000 N                   | 6763 549    |           | 0000 N                  |
| 6732 320    |           | 00                      | 6763 939    |           | 0000 N                  |
| 6732 921    |           | 0000                    | 6764 330    |           | 000 Nd?                 |
| 6733 410    | Fe        | 1                       | 6767 602    |           | 0000 Nd?                |
| 6733 783    |           | 0000 Nd?                | 6768 028 s  | Ni        | 4                       |
| 6734 524    |           | 000 N                   | 6768 248    |           | 0000                    |
| 6735 277    |           | 0000                    | 6769 930    |           | 000                     |
| 6735 708    |           | 000 N                   | 6771 310    |           | 0 d                     |
| 6736 099    |           | 0000 N                  | 6771 789    | -, Co     | 0000                    |
| 6736 798    |           | 000                     | 6772 152    |           | 0000                    |
| 6737 619    |           | 0000 N                  | 6772 568 s  | Ni        | 2                       |
| 6738 230    |           | 0                       | 6775 047    |           | 0000 N                  |
| 6738 485    |           | 00                      | 6776 595    |           | 0000 N                  |
| 6739 080    |           | 00 N                    | 6777 653    |           | 00                      |
| 6739 370    |           | 0000                    | 6778 022    |           | 0000 N                  |
| 6739 775    |           | 0                       | 6781 172    |           | 0000 N                  |
| 6740 244    |           | 0000                    | 6782 061    |           | 0000 N                  |
| 6741 268    |           | 0000                    | 6782 465    |           | 0000 N                  |
| 6741 880    |           | 0 N                     | 6782 748    |           | 000 N                   |
| 6742 535    |           | 0000                    | 6783 609    |           | 0000 N                  |
| 6742 816    |           | 0000 N                  | 6783 960    |           | 0000 N                  |
| 6743 381    | Tl        | 1                       | 6784 460    |           | 00                      |
|             |           |                         |             |           | 000 N                   |

TABLE OF SOLAR SPECTRUM WAVE-LENGTHS 139

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 6785 306    | Fe        | 000 N                   | 6820 630 s  | Fe        | 2                       |
| 6786 010    |           | 000 N                   | 6820 987    |           | 0000 N                  |
| 6786 450    |           | 0000 N                  | 6822 293    |           | 0000 N                  |
| 6786 706    |           | 000 N                   | 6825 108    |           | 000 N                   |
| 6787 100 s  |           | 1                       | 6827 529    |           | 0000                    |
| 6787 850    |           | 0000 N                  | 6828 215    |           | 000 N                   |
| 6789 400    |           | 000 N                   | 6828 445    | Fe        | 0000 N                  |
| 6789 776    |           | 0000                    | 6828 850 s  |           | 2                       |
| 6790 206    |           | 000                     | 6829 293    |           | 0000                    |
| 6790 569    |           | 0000                    | 6829 832    |           | 0000                    |
| 6790 933    |           | 000                     | 6831 098    |           | 0000                    |
| 6792 577    |           | 0000                    | 6831 730    |           | 0000                    |
| 6793 088    |           | 0000 N d?               | 6832 727    |           | 0000                    |
| 6793 520    |           | 00                      | 6833 501    |           | 00                      |
| 6793 875    |           | 0 N                     | 6833 845    |           | 0000 N                  |
| 6794 219    |           | 0000                    | 6835 622    |           | 0000 N                  |
| 6794 560    |           | 000                     | 6836 956    |           | 0000 N                  |
| 6794 870    |           | 000                     | 6837 268    |           | 0                       |
| 6795 675    |           | 000 Nd?                 | 6838 612    |           | 0000 N                  |
| 6796 045    |           | 000 N                   | 6838 980    |           | 00                      |
| 6796 375    |           | 0                       | 6839 088    |           | 0                       |
| 6796 737    |           | 000 N                   | 6840 086    |           | 1                       |
| 6797 061    |           | 0000                    | 6840 698    | Fe        | 0000 N                  |
| 6797 410    |           | 0000                    | 6841 598 s  |           | 3                       |
| 6798 715    |           | 00                      | 6841 897    |           | 0000 N                  |
| 6799 136    |           | 0000 N                  | 6842 294    |           | 0                       |
| 6800 265    |           | 0000                    | 6842 624    |           | 0000 Nd?                |
| 6800 855    |           | 00 N                    | 6842 945    |           | 1                       |
| 6801 450    | Fe        | 0000 N                  | 6843 420    | Fe        | 000 N                   |
| 6802 097    |           | 0000                    | 6843 913 s  |           | 3                       |
| 6804 102    |           | 0000                    | 6844 939    |           | 0000                    |
| 6804 258    |           | 0                       | 6845 937    |           | 0000                    |
| 6804 545    | Fe        | 0                       | 6847 860    |           | 000                     |
| 6805 126    | Fe        | 0000                    | 6848 468    |           | 0000 N                  |
| 6805 354    |           | 000                     | 6848 823    |           | 0 Nd?                   |
| 6806 000    |           | 0000 N                  | 6849 559    |           | 000 N                   |
| 6806 593    |           | 0000 N                  | 6850 110    |           | 0000 N                  |
| 6807 103 s  | Fe        | 1                       | 6850 696    |           | 00 N                    |
| 6807 630    |           | 0000 Nd?                | 6851 309    |           | 0000 N                  |
| 6808 141    |           | 0000 N                  | 6851 910    |           | 000                     |
| 6809 017    |           | 0000 N                  | 6852 980    |           | 000                     |
| 6809 878    | Fe        | 0000 N                  | 6854 109    |           | 0000                    |
| 6810 519 s  |           | 3                       | 6854 590    | Fe        | 000                     |
| 6812 605    |           | 000 N                   | 6854 796    |           | 0000                    |
| 6813 865    |           | 000 Nd?                 | 6855 105    |           | 00                      |
| 6814 160    | Co        | 0000 N                  | 6855 419 s  |           | 3                       |
| 6815 210    |           | 0                       | 6855 700    |           | 0000                    |
| 6817 903    |           | 0000                    | 6855 990    |           | 0                       |
| 6819 845    |           | 00 Nd?                  | 6856 290    |           | 0000                    |
| 6820 098    |           | 000 Nd?                 | 6857 515    |           | 0                       |

| Wave length               | Substance | Intensity and Character | Wave length | Substance      | Intensity and Character |
|---------------------------|-----------|-------------------------|-------------|----------------|-------------------------|
| 6857 773                  |           | 0000 N                  | 6875 415    |                | 0000 N                  |
| 6858 109                  |           | 0000 N                  | 6875 830 s  | A (O)          | 13                      |
| 6858 415                  |           | 2                       | 6876 255    |                | 000 N                   |
| 6858 661                  |           | 0000                    | 6876 595    |                | 000 N                   |
| 6858 863                  |           | 0000                    | 6876 958 s  | A (O)          | 13                      |
| 6859 227                  |           | 0000                    | 6877 440    |                | 0000Nd?                 |
| 6859 752                  |           | 0000                    | 6877 882 s  | A (O)          | 12                      |
| 6860 007                  |           | 000                     | 6878 342    |                | 0000 N                  |
| 6860 358                  |           | 0000                    | 6878 570    |                | 0000Nd?                 |
| 6860 590                  |           | 000                     | 6878 800    |                | 0000 N                  |
| 6861 044                  |           | 0000                    | 6879 288 s  | A (O)          | 12                      |
| 6861 213                  |           | 000                     | 6879 528    |                | 0000                    |
| 6861 529                  |           | 0000                    | 6879 784    |                | 000                     |
| 6861 770                  | 11?       | 000                     | 6880 040    |                | 0000                    |
| 6862 014                  |           | 0000                    | 6880 172 s  | A (O)          | 6                       |
| 6862 210                  |           | 0                       | 6880 455    |                | 0000                    |
| 6862 431                  |           | 0000 N                  | 6880 887    |                | 00                      |
| 6862 760                  |           | 1                       | 6881 305    |                | 0000 N                  |
| 6863 119                  |           | 0000                    | 6881 720    |                | 00                      |
| 6864 048                  |           | 0000                    | 6881 983 s  | Cr             | 0                       |
| 6864 585                  |           | 000                     | 6882 784 s  | C <sub>1</sub> | 1                       |
| 6864 775                  |           | 0000                    | 6883 325 s  | C <sub>1</sub> | 1                       |
| 6865 206                  |           | 0000                    | 6883 635    |                | 0000                    |
| 6865 704                  |           | 0000                    | 6884 076 s  | A (O)          | 10                      |
| 6865 906                  |           | 000                     | 6884 656    |                | 0000 N                  |
| 6866 243                  |           | 0000                    | 6885 221    | A?             | 0000                    |
| 6866 604                  |           | 000 N                   | 6885 598    | A?             | 0000                    |
| 6867 037                  |           | 0000 N                  | 6886 000 s  | A (O)          | 11                      |
| 6867 457 s <sup>*</sup>   | A (O)     | 6d?                     | 6886 446    | A?             | 0000 N                  |
| 6867 631                  | A         | 1                       | 6886 990 s  | A (O)          | 12                      |
| 6867 800 s                | A (O)     | 5                       | 6887 242    |                | 000                     |
| 6868 092 s                | A         | 0 Nd?                   | 6887 444    |                | 000                     |
| 6868 336 } s              | A (O)     | 6                       | 6887 765    | A              | 000 Nd?                 |
| 6868 478 } s              | A (O)     | 6                       | 6887 969    | A              | 000                     |
| 6868 645 } s              | A         | 1                       | 6888 250    | A              | 000                     |
| 6868 795 } s              | A         | 3                       | 6888 670    |                | 0000                    |
| 6869 142 s                | A (O)     | 7                       | 6888 830    |                | 0000                    |
| 6869 353 s                | A (O)     | 6                       | 6889 192 s  | A (O)          | 13                      |
| 6869 850                  | A?        | 00                      | 6889 490    |                | 000                     |
| 6870 116 } s <sup>2</sup> | A (O)     | 7 } d                   | 6889 827    |                | 0000Nd?                 |
| 6870 249 } s <sup>2</sup> | A (O)     | 7 } d                   | 6890 151 s  | A (O)          | 14                      |
| 6870 853                  | A?        | 000 N                   | 6890 460    |                | 000                     |
| 6871 180 s                | A (O)     | 8                       | 6891 000    | A              | 000                     |
| 6871 532 s                | A (O)     | 10                      | 6891 180    | A              | 000                     |
| 6872 105                  | A?        | 000                     | 6891 617    |                | 0000 N                  |
| 6872 486 s                | A (O)     | 11                      | 6891 843    | A              | 000                     |
| 6873 080 s                | A (O)     | 12                      | 6891 970    | A              | 0000                    |
| 6873 630                  | A?        | 0000                    | 6892 618 s  | A (O)          | 14                      |
| 6874 037 s                | A (O)     | 12                      | 6893 099    |                | 000                     |
| 6874 899 s                | A (O)     | 13                      | 6893 560 s  | A (O)          | 15                      |

<sup>\*</sup> First line in the head of the B group, due to atmospheric oxygen  
<sup>1</sup> First line in the tail of the B group  
<sup>2</sup> Principal line in the head of the B group



| Wave length | Substance | Intensity and Character | Wave length | Substance      | Intensity and Character |
|-------------|-----------|-------------------------|-------------|----------------|-------------------------|
| 6894 068    |           | 0000 N                  | 6913 810    |                | 0000                    |
| 6894 320    |           | 0000 N                  | 6913 945    |                | 000                     |
| 6894 660    | A         | 000                     | 6914 158    |                | 0000                    |
| 6895 200    | A?        | 000 N                   | 6914 337 s  | A (O)          | 11                      |
| 6895 630    |           | 000 N                   | 6914 668    |                | 0000                    |
| 6895 737    | A?        | 0000                    | 6914 823 s  | N <sub>1</sub> | 4                       |
| 6896 289 s  | A (O)     | 14                      | 6915 075    |                | 0000 N                  |
| 6896 660    |           | 0000 N                  | 6915 270    |                | 0000 N                  |
| 6896 882    |           | 0000                    | 6915 775    | A              | 000 N                   |
| 6897 208 s  | A (O)     | 15                      | 6916 136    | A              | 000 N                   |
| 6897 673    |           | 0000 N                  | 6916 325    |                | 0000 N                  |
| 6897 837    |           | 0000 N                  | 6916 743    | A              | 0000 N                  |
| 6898 160    | A?        | 000 N                   | 6916 948 s  |                | 2                       |
| 6898 556    |           | 00                      | 6917 235    |                | 000 N                   |
| 6898 766    |           | 0000 N                  | 6917 710    | A              | 000 Nd?                 |
| 6899 130    |           | 0000 N                  | 6918 015    |                | 0000                    |
| 6899 710    |           | 0000                    | 6918 370 s  | A (O)          | 9                       |
| 6900 199 s  | A (O)     | 14                      | 6918 655    | A?             | 000                     |
| 6900 734    |           | 000 N                   | 6918 860    |                | 0000                    |
| 6901 117 s  | A (O)     | 15                      | 6919 250 s  | A (O)          | 9                       |
| 6901 527    |           | 0000                    | 6919 556    | A              | 000                     |
| 6901 810    |           | 000 N                   | 6920 430    |                | 00                      |
| 6902 065    |           | 0000                    | 6920 650    |                | 0000                    |
| 6902 443    |           | 0000                    | 6921 135    | A?             | 0000                    |
| 6902 901    |           | 0000                    | 6921 615    | A?             | 000                     |
| 6903 120    |           | 00                      | 6921 834    | A?             | 0000                    |
| 6904 362 s  | A (O)     | 14                      | 6922 238    | A?             | 000                     |
| 6904 785    |           | 000                     | 6922 548    | A?             | 0000                    |
| 6905 083    |           | 0000                    | 6922 735    | A              | 000                     |
| 6905 271 s  | A (O)     | 14                      | 6922 912    |                | 0000                    |
| 6905 540    |           | 000                     | 6923 553 s  | A (O)          | 9                       |
| 6905 915    |           | 0000                    | 6924 080    | Cr?            | 0000 N                  |
| 6906 295    | A         | 000                     | 6924 427 s  | A (O)          | 9                       |
| 6906 560    |           | 000 Nd?                 | 6924 713    | A              | 000 N                   |
| 6907 282    | A         | 000                     | 6925 134    | Cr?            | 0000 N                  |
| 6907 920    | A         | 000                     | 6925 543    |                | 1                       |
| 6908 360    |           | 0000                    | 6925 752    |                | 0000                    |
| 6908 783 s  | A (O)     | 13                      | 6926 170    |                | 0000                    |
| 6908 251    |           | 0000 N                  | 6926 363    |                | 0                       |
| 6909 676 s  | A (O)     | 13                      | 6926 660    |                | 0000                    |
| 6910 270    |           | 0000 N                  | 6926 850    |                | 000                     |
| 6910 510    | A?        | 000 N                   | 6927 020    | A              | 00                      |
| 6910 994    |           | 0000                    | 6927 520    | A?             | 000                     |
| 6911 310    | A         | 000 N                   | 6927 948    |                | 0000                    |
| 6911 790    | A-        | 00 N                    | 6928 500    |                | 000                     |
| 6912 173    | A         | 000 N                   | 6928 796    |                | 0000                    |
| 6912 690    |           | 0000 N                  | 6928 977 s  | A (O)          | 4                       |
| 6913 038    | A         | 000 N                   | 6929 227    | A?             | 0000                    |
| 6913 284    | 11?       | 0000                    | 6929 375    | A              | 000                     |
| 6913 448 s  | A (O)     | 11                      | 6929 560    | A (wv)         | 00                      |

| Wave length | Substance     | Intensity and Character | Wave length  | Substance      | Intensity and Character |
|-------------|---------------|-------------------------|--------------|----------------|-------------------------|
| 6929 840 s  | A (O)         | 4                       | 6943 379     |                | 0000                    |
| 6930 075    | A             | 00                      | 6943 689     |                | 0000                    |
| 6930 185    | A             | 000                     | 6943 904     |                | 0000                    |
| 6930 600    |               | 0000 N                  | 6944 060     | $\Lambda$ (wv) | 3                       |
| 6930 890    |               | 00 N                    | 6944 510     |                | 0000                    |
| 6931 355    |               | 0000                    | 6944 861     |                | 0000                    |
| 6931 575    | A             | 00 N                    | 6945 135     |                | 0000                    |
| 6932 012    | A             | 00                      | 6945 477     |                | 4                       |
| 6932 298    |               | 0000                    | 6945 745     |                | 0000 N                  |
| 6932 445    | A             | 00                      | 6946 160     |                | 000 N                   |
| 6932 765    |               | 0000                    | 6946 638     |                | 0000                    |
| 6933 024    |               | 0000                    | 6946 860     | A (O)          | 0                       |
| 6933 305    |               | 0 N                     | 6947 191     |                | 0000 N                  |
| 6933 469    |               | 0000                    | 6947 406     |                | 0000                    |
| 6933 715    |               | 000                     | 6047 702     | $\Lambda$ (O)  | 0                       |
| 6933 887    |               | 2                       | 6947 782 s   | $\Lambda$ (wv) | 5                       |
| 6934 075    | A (wv)        | 2                       | 6947 863     | $\Lambda$ wv   | 00                      |
| 6934 325    |               | 0000                    | 6948 146     |                | 0000 N                  |
| 6934 468    |               | 0000                    | 6949 240     | A (wv)         | 1                       |
| 6934 670 s  | A (O)         | 2                       | 6949 310     | A (wv)         | 1                       |
| 6934 870    |               | 000                     | 6950 188     |                | 0000 N                  |
| 6935 153    |               | 0000                    | 6951 010     | A (wv)         | 1                       |
| 6935 355    | A?            | 000                     | 6951 518     |                | 1                       |
| 6935 530 s  | A (O)         | 2                       | 6951 900     | A?             | 000                     |
| 6935 704    | A?            | 0000                    | 6952 593     | $\Lambda$      | 000 N                   |
| 6936 075    | A             | 000 N                   | 6953 337     | $\Lambda$ (O)  | 00 N                    |
| 6936 290    |               | 0000                    | 6953 828 } s | $\Lambda$ (wv) | 1                       |
| 6936 755    |               | 000 N                   | 6954 020 } s | $\Lambda$ (wv) | 00                      |
| 6937 122    |               | 0000                    | 6954 147     | $\Lambda$ (O)  | 000                     |
| 6937 420    |               | 000 N                   | 6954 718     | A ?            | 0000 N                  |
| 6937 957    | A (wv)        | 2 N                     | 6955 307     |                | 00                      |
| 6938 195    |               | 000                     | 6955 507     | A              | 0000                    |
| 6938 520    | A (wv)        | 1 N                     | 6955 915     | A (wv)         | 000 N                   |
| 6938 727    |               | 000                     | 6956 660 } s | A (wv)         | 4                       |
| 6939 050    |               | 000                     | 6956 746 } s | A (wv)         | 1                       |
| 6939 460    |               | 0000                    | 6957 675     | A              | 000                     |
| 6939 875    | A (wv)        | 2                       | 6957 985     |                | 0000                    |
| 6940 030    |               | 0000                    | 6958 753     | A?             | 0000                    |
| 6940 270    |               | 0000                    | 6959 704 s   | A (wv)         | 3                       |
| 6940 436    | A (wv)        | 2                       | 6960 105     | A (O)          | 000 N                   |
| 6940 625    | A (O)         | 1                       | 6960 590     |                | 00                      |
| 6940 861    |               | 0000 N                  | 6960 880     | A (O)          | 0000                    |
| 6941 023    |               | 0000                    | 6961 136     |                | 0000                    |
| 6941 260    | A (wv)        | 000 N                   | 6961 515 s   | A (wv)         | 4                       |
| 6941 475    | A (O), A (wv) | 1                       | 6962 075     |                | 0000 N                  |
| 6941 979    |               | 0000 N                  | 6962 213     |                | 0000 N                  |
| 6942 402    | A (wv)        | 2                       | 6963 100     |                | 000 N                   |
| 6942 630    | A (wv)        | 1                       | 6963 900     | A              | 000 N                   |
| 6942 746    |               | 0000                    | 6964 447     |                | 0000                    |
| 6943 083    |               | 000                     | 6964 812     | A (wv)         | 1                       |

TABLE OF SOLAR SPECTRUM WAVE-LENGTHS 143

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 6965 320    | A         | 000 N                   | 6992 065    | A         | 000 N                   |
| 6965 716    |           | 00                      | 6992 571    |           | 0000                    |
| 6966 158    |           | 000                     | 6993 145    | A         | 00 N                    |
| 6967 054    |           | 0000                    | 6993 776    | A (wv)    | 2                       |
| 6968 837    |           | 0000                    | 6994 360    | A (wv)    | 1                       |
| 6969 302    |           | 0000                    | 6994 635    |           | 0000                    |
| 6970 763    | A         | 00                      | 6994 880    | A         | 00                      |
| 6971 135    | A (wv)    | 0                       | 6995 260    |           | 0000                    |
| 6971 400    |           | 0000                    | 6996 930    |           | 0000                    |
| 6971 772    |           | 000                     | 6997 420    | A?        | 0000                    |
| 6972 205    |           | 00                      | 6998 070    | A?        | 0000                    |
| 6973 132    |           | 0000                    | 6998 283    | A         | 00                      |
| 6973 743    | A         | 0000 N                  | 6998 500    |           | 0000 N                  |
| 6974 600    |           | 0000                    | 6998 978    | A (wv)    | 0                       |
| 6974 996    | A?        | 000 N                   | 6999 223    | A (wv)    | 2                       |
| 6975 706    |           | 0                       | 6999 488    | A         | 0000                    |
| 6975 976    |           | 0000                    | 6999 823    | A         | 0000                    |
| 6976 535    |           | 000 N                   | 7000 155 s  |           | 1                       |
| 6976 783    |           | 1                       | 7000 411    |           | 0000                    |
| 6977 198    |           | 00                      | 7000 555    |           | 0000                    |
| 6977 715    | A (wv)    | 3                       | 7000 880    |           | 00                      |
| 6978 138    |           | 0000                    | 7001 125    | A         | 000                     |
| 6978 310    |           | 0000                    | 7001 475    |           | 0000                    |
| 6978 670 s  |           | 1 N                     | 7001 810    |           | 00                      |
| 6979 120    |           | 2                       | 7002 385    | A         | 00 N                    |
| 6979 420    | A         | 000 N                   | 7002 870    |           | 0000 N                  |
| 6979 610    |           | 0000                    | 7003 837    |           | 1                       |
| 6980 060    |           | 1                       | 7004 240    |           | 0000 N                  |
| 6980 620    | A?        | 0000 N                  | 7004 575    | A (wv)    | 0 N                     |
| 6981 196    |           | 000                     | 7004 995    | A (wv)    | 2                       |
| 6981 722    | A (wv)    | 1                       | 7005 365    | A (wv)    | 0 N                     |
| 6981 860    | A?        | 000                     | 7005 608    | A         | 0000                    |
| 6982 501    |           | 000 N                   | 7005 850    | A         | 000                     |
| 6982 780    |           | 0000 N                  | 7006 157 s  |           | 1                       |
| 6983 810    |           | 000 N                   | 7006 420    | A         | 000 Nd?                 |
| 6984 380    |           | 0000 N                  | 7006 915    | A         | 000                     |
| 6984 870    |           | 0000                    | 7007 140    |           | 0000 N                  |
| 6985 220    | A (wv)    | 0 N                     | 7007 385    | A         | 0000 N                  |
| 6985 776    |           | 0000                    | 7007 970    | A         | 000 N                   |
| 6986 080    | A         | 000                     | 7008 225    |           | 0                       |
| 6986 833 s  | A (wv)    | 3 N                     | 7008 515    | A         | 00 N                    |
| 6988 125    | A (wv)    | 0 N                     | 7008 920    | A?        | 0000                    |
| 6988 536    |           | 0000 N                  | 7009 485    | A         | 000 N                   |
| 6988 805    |           | 0                       | 7010 135    | A (wv)    | 0 N                     |
| 6989 075    |           | 0000                    | 7010 618    |           | 000 N                   |
| 6989 237 s  | A (wv)    | 3                       | 7010 920    | A         | 0000 N                  |
| 6989 825    |           | 000 N                   | 7011 230    | A         | 000 N                   |
| 6990 230    | A?        | 0000                    | 7011 590 s  | A (wv)    | 2                       |
| 6990 632    | A (wv)    | 1                       | 7012 130    |           | 0000                    |
| 6991 295    | A         | 000                     | 7012 490    | A         | 0000                    |

| Wave length  | Substance | Intensity<br>and<br>Character | Wave length | Substance | Intensity<br>and<br>Character |
|--------------|-----------|-------------------------------|-------------|-----------|-------------------------------|
| 7012 880     |           | o N                           | 7037 800    | A         | I                             |
| 7013 550     |           | ooo N                         | 7038 061    |           | 0000                          |
| 7014 080     |           | ooo                           | 7038 202    |           | 0000                          |
| 7014 810     |           | 0000 N                        | 7038 500 s  |           | I                             |
| 7015 260     |           | ooo                           | 7039 040    |           | o                             |
| 7015 560     | A         | ooo N                         | 7039 560    | A         | o N                           |
| 7015 800     |           | 0000 N                        | 7040 053 s  |           | I N                           |
| 7016 176     |           | 0000                          | 7040 861    |           | 0000                          |
| 7016 330 s   | ,A (wi)   | I                             | 7042 025    |           | oo N                          |
| 7016 675 s   | -,A (wv)  | 3                             | 7042 745    |           | 0000                          |
| 7017 020     |           | ooo Nd                        | 7044 265    |           | 0000 N                        |
| 7017 575     | ,A        | oo Nd                         | 7044 777    |           | ooo                           |
| 7017 935     |           | o                             | 7044 952    |           | oo                            |
| 7018 250     |           | 0000                          | 7045 313    |           | ooo                           |
| 7019 043     | A         | ooo                           | 7045 517    |           | 0000                          |
| 7019 620     | A         | o                             | 7046 056    |           | 0000                          |
| 7020 445     | A?        | 0000                          | 7047 133    |           | oo                            |
| 7020 900     | A         | ooo                           | 7047 631    |           | ooo                           |
| 7021 100     | A         | ooo                           | 7048 291    |           | 0000                          |
| 7021 790     | A         | 0000                          | 7049 273    |           | 0000                          |
| 7022 302     |           | 0000                          | 7050 783    | A?        | ooo                           |
| 7022 662     |           | ooo                           | 7051 115    |           | o                             |
| 7022 810     | A         | ooo                           | 7052 030    | A?        | 0000 N                        |
| 7023 230 s   |           | 2                             | 7052 665    | A?        | ooo N                         |
| 7023 550     |           | 0000                          | 7053 070    |           | I                             |
| 7023 770 s   | A (wv)    | 2                             | 7053 191    | A?        | o                             |
| 7023 983     |           | 0000 N                        | 7053 755    |           | 0000 N                        |
| 7024 340     |           | o                             | 7054 280    |           | ooo N                         |
| 7024 660     |           | 0000                          | 7054 970    | A         | oo N                          |
| 7024 913 } s |           | I                             | 7056 210    |           | oo N                          |
| 7025 140 } s | A         | o                             | 7056 750    |           | 0000                          |
| 7026 660     | A         | oo                            | 7057 260    | A         | o N                           |
| 7026 890     |           | 0000                          | 7057 590    |           | 0000                          |
| 7027 213 s   | ,A (wv)   | o                             | 7057 820    |           | 0000                          |
| 7027 740 s   | ,A (wv)   | 2                             | 7058 186    |           | 0000                          |
| 7028 115     | A         | o                             | 7058 490    | A?        | ooo                           |
| 7028 466     |           | 0000                          | 7059 825    |           | 0000 N                        |
| 7028 860     |           | 0000 N                        | 7060 314    |           | 0000                          |
| 7029 260     | A         | o                             | 7060 725    |           | I N                           |
| 7029 390     |           | oo                            | 7061 780    | A         | oo N                          |
| 7029 975     | A         | 0000 N                        | 7062 265    |           | 0000                          |
| 7030 295     |           | o                             | 7062 750    |           | 0000                          |
| 7030 657     |           | 0000                          | 7063 255    |           | ooo N                         |
| 7031 215     | A         | oo N                          | 7063 770    | A?        | o N                           |
| 7032 585     |           | I                             | 7064 400    |           | 0000                          |
| 7034 360     | A?        | 0000 N                        | 7064 917    | A?        | ooo                           |
| 7034 670     | A         | 0000 N                        | 7065 496    |           | 0000                          |
| 7035 170 s   |           | 2 N                           | 7065 920    |           | I                             |
| 7036 129     |           | 0000                          | 7066 495    |           | ooo Nd?                       |
| 7037 465     | A         | o                             | 7067 210    |           | oo N                          |

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 7067 742    |           | ooo N                   | 7097 395    |           | ooo N                   |
| 7068 265    |           | ooo Nd?                 | 7097 940    |           | oooo                    |
| 7068 685    |           | 2                       | 7099 219    |           | oooo N                  |
| 7068 870    |           | ooo N                   | 7099 812    |           | oooo N                  |
| 7069 350    |           | oooo N                  | 7100 415    |           | ooo N                   |
| 7069 820    |           | oooo                    | 7100 960    |           | oooo N                  |
| 7070 934    |           | oooo                    | 7102 222    |           | oooo N                  |
| 7072 130    |           | o N                     | 7102 560    |           | ooo N                   |
| 7072 720    |           | ooo                     | 7103 430    |           | ooo                     |
| 7073 070    |           | oooo                    | 7105 422    |           | oooo                    |
| 7073 890    |           | ooo N                   | 7106 434    | A?        | ooo Nd?                 |
| 7074 757    |           | oooo N                  | 7107 300    |           | oooo N                  |
| 7075 188    |           | oooo                    | 7107 740    |           | o                       |
| 7075 875    |           | oooo                    | 7108 187    |           | oooo N                  |
| 7077 087    |           | oooo                    | 7108 387    |           | oooo N                  |
| 7078 109    |           | ooo N                   | 7109 310    | A         | ooo Nd?                 |
| 7078 540    | A?        | oo N                    | 7110 700    |           | oooo N                  |
| 7079 130    |           | ooo N                   | 7111 180    |           | 1                       |
| 7079 685    |           | oooo                    | 7111 730    | A         | ooo N                   |
| 7079 870    |           | ooo N                   | 7112 199    | A         | oooo                    |
| 7081 210    |           | ooo                     | 7112 450    |           | o                       |
| 7082 445    |           | oooo N                  | 7113 010    |           | oooo N                  |
| 7082 755    |           | oooo N                  | 7113 455    | A?        | oo N                    |
| 7083 104    |           | oooo N                  | 7113 700    |           | oooo                    |
| 7083 680    |           | oo N                    | 7113 870    |           | oooo                    |
| 7083 993    |           | ooo N                   | 7114 313    | A?        | oooo                    |
| 7084 235    |           | ooo N                   | 7114 447    | A?        | oooo                    |
| 7084 531    |           | oooo                    | 7114 860    |           | ooo                     |
| 7084 920    |           | oooo N                  | 7115 444    | A?        | ooo                     |
| 7085 265    |           | 2 N                     | 7115 591    | A?        | oooo                    |
| 7085 810    |           | oooo N                  | 7116 670    |           | oooo N                  |
| 7086 590    |           | oooo                    | 7117 240    |           | ooo Nd?                 |
| 7087 008    |           | oo                      | 7117 549    |           | ooo                     |
| 7087 550    |           | oooo N                  | 7117 948    |           | oooo N                  |
| 7088 099    |           | oooo N                  | 7118 390    | A?        | ooo                     |
| 7088 430    | A?        | oo N                    | 7118 554    | A         | 1                       |
| 7090 000    |           | oooo N                  | 7119 254    |           | oooo                    |
| 7090 660    |           | 2                       | 7119 955    |           | ooo N                   |
| 7091 430    |           | oooo                    | 7120 320    |           | ooo N                   |
| 7091 640    |           | ooo                     | 7121 965    |           | oooo N                  |
| 7092 220    |           | ooo N                   | 7122 484    |           | 4                       |
| 7093 120    |           | oooo                    | 7123 000    | A?        | oooo                    |
| 7093 395    |           | ooo                     | 7125 269    | A?        | oooo                    |
| 7094 009    |           | oooo                    | 7126 414    | A?        | oooo                    |
| 7094 305    |           | oooo                    | 7127 087    |           | oooo N                  |
| 7094 615    |           | oooo                    | 7127 845    |           | o N                     |
| 7095 295    |           | oooo N                  | 7128 390    | A?        | ooo N                   |
| 7095 690    |           | o                       | 7128 810    |           | oooo N                  |
| 7096 140    |           | ooo                     | 7129 410    | A?        | oooo N                  |
| 7096 660    |           | oooo                    | 7130 140    |           | oooo N                  |

| Wave length | Substance | Intensity and Character | Wave length           | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-----------------------|-----------|-------------------------|
| 7131 204    |           | 3                       | 7164 725 <sup>*</sup> | , A       | 2                       |
| 7131 650    |           | 000 N                   | 7165 018              |           | 000 N                   |
| 7132 043    | A?        | 0000                    | 7165 396              |           | 0000 N                  |
| 7133 263    |           | 1                       | 7165 845              | A,        | 1 N                     |
| 7133 660    |           | 000 N                   | 7166 355              | A         | 000 N                   |
| 7134 423    | A         | 00 N                    | 7166 553              | A         | 0000                    |
| 7136 120    |           | 000 N                   | 7166 931              |           | 0000                    |
| 7137 720    | A         | 1 N                     | 7167 305              | A         | 000 Nd?                 |
| 7138 209    | A?        | 0000 N                  | 7167 645              | A         | 00                      |
| 7139 215    |           | 000                     | 7168 170              | ,A        | 4 N                     |
| 7139 973    |           | 0000 N                  | 7168 465              | A         | 0000                    |
| 7140 568    | A         | 000 N                   | 7168 748              | A         | 0000                    |
| 7141 360    | A         | 0000                    | 7169 017              | A         | 0000                    |
| 7141 930    |           | 0000 N                  | 7169 355              | A?        | 00                      |
| 7142 451    | A         | 0000 N                  | 7170 162              | A?        | 0000                    |
| 7142 800    |           | 0                       | 7170 360              | A         | 00                      |
| 7143 257    | A         | 1                       | 7170 619              | A?        | 0000                    |
| 7143 660    |           | 0000                    | 7170 833              | ,A        | 1                       |
| 7144 229    |           | 0000                    | 7171 130              | A         | 0000 N                  |
| 7145 022    | A         | 0000                    | 7172 250              | A         | 300 N                   |
| 7145 615    |           | 1                       | 7172 970              | A,        | 1                       |
| 7147 939    | A         | 2 N                     | 7173 200              |           | 000 N                   |
| 7148 435    |           | 3 N                     | 7173 675              | A,        | 2                       |
| 7148 793    |           | 0000                    | 7174 040              | A         | 0                       |
| 7148 995    |           | 000 N                   | 7174 440              | A         | 0                       |
| 7149 574    |           | 0000                    | 7174 930              |           | 0000 N                  |
| 7150 100    | A?        | 0000                    | 7175 580              | A?        | 0000Nd?                 |
| 7150 450    | A?        | 0000 N                  | 7176 225              | A,        | 1                       |
| 7150 947    | A         | 1                       | 7176 430              | A         | 1                       |
| 7151 442    | A         | 1                       | 7176 719              |           | 0000                    |
| 7151 765    |           | 00                      | 7177 170              | A         | 0                       |
| 7152 375    |           | 0000                    | 7177 390              | A         | 0                       |
| 7153 627    | A?        | 0000                    | 7177 640              | A,        | 2                       |
| 7154 030    |           | 0000                    | 7177 915              | A         | 2 N                     |
| 7155 014    |           | 0000 N                  | 7178 690              | A         | 00 N                    |
| 7155 945    |           | 0 N                     | 7179 060              |           | 0000                    |
| 7156 700    | A         | 1 N                     | 7179 570              | A         | 000                     |
| 7157 438    |           | 0000                    | 7179 910              |           | 0000 N                  |
| 7158 084    | A?        | 0000                    | 7180 300              | A         | 000                     |
| 7158 790    |           | 000 N                   | 7181 500              | A         | 0                       |
| 7159 045    | A         | 0 N                     | 7181 790              | ,A        | 2                       |
| 7159 590    | A         | 00 N                    | 7182 045              | A         | 1                       |
| 7160 602    |           | 0000 N                  | 7182 260              | A?        | 00                      |
| 7161 154    |           | 0000 N                  | 7182 658              | A         | 0000                    |
| 7161 746    |           | 0000 N                  | 7183 089              | A         | 0000                    |
| 7162 352    | A         | 00 N                    | 7184 650              | A         | 3                       |
| 7162 630    |           | 000 N                   | 7184 785              |           | 4                       |
| 7163 012    |           | 0000                    | 7185 205              |           | 000 N                   |
| 7163 469    |           | 0000                    | 7185 580              |           | 0000 N                  |
| 7164 125    | A?        | 000 N                   | 7185 870              |           | 0000 N                  |

<sup>\*</sup>This is the beginning of the "a" group, most of the atmospheric lines are produced by water vapor, but as the identification is somewhat uncertain in many cases, and as some of the lines may be due to other atmospheric gases, they have simply been marked A

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 7186 405    | A         | 4                       | 7209 780    | A,-       | 3                       |
| 7186 655    | A         | 5                       | 7210 679    | A         | 000 N                   |
| 7187 280    | A         | 2                       | 7211 473    | A         | 1                       |
| 7187 645    | ,A        | 5 N                     | 7212 308    | A         | 000 N                   |
| 7188 286    |           | 0000 N                  | 7212 740    | A         | 00                      |
| 7188 875    |           | 0000 N                  | 7214 166    | A         | 000                     |
| 7189 242    | A         | 0000                    | 7215 042    | A,-       | 000 N d                 |
| 7189 445    | A         | 00                      | 7215 782    | A?        | 000 N                   |
| 7189 740    |           | 0000                    | 7216 482    | A         | 000                     |
| 7190 159    |           | 000                     | 7216 791    | A,-       | 2                       |
| 7190 427    |           | 000                     | 7216 927    | A?        | 0000                    |
| 7191 755    | A,-       | 6 N                     | 7217 479    |           | 0000 N                  |
| 7192 150    | A         | 2 N                     | 7218 323    | A         | 000 N                   |
| 7192 745    | A         | 1 N                     | 7218 799    |           | 000 Nd                  |
| 7193 039    |           | 0000                    | 7219 337    | A         | 0000 N                  |
| 7193 475    | A         | 000 N                   | 7219 987    |           | 0                       |
| 7193 835    | A         | 3                       | 7220 306    | A         | 0000 N                  |
| 7194 040    | A         | 3                       | 7221 088    | A         | 0000 N                  |
| 7194 655    |           | 0000                    | 7221 492    |           | 0                       |
| 7194 871    |           | 0000                    | 7221 870    | A?        | 0000                    |
| 7195 290    | ,A        | 2                       | 7222 691    |           | 000 N                   |
| 7195 827    |           | 0000                    | 7223 216    | A         | 00 N                    |
| 7196 070    | A         | 0 N                     | 7223 930 s  | A         | 3                       |
| 7196 716    | A?        | 0000 N                  | 7224 414    |           | 0000                    |
| 7197 300    | A         | 0                       | 7224 791    |           | 000 N                   |
| 7197 515    | A         | 1                       | 7225 356    |           | 0000                    |
| 7197 698    | A         | 000                     | 7226 522    | ,A        | 000 N                   |
| 7198 145    | A         | 1 N                     | 7227 781 s  |           | 3                       |
| 7198 705    | A         | 2                       | 7228 468    | A?        | 0000                    |
| 7199 152    |           | 0000 N                  | 7229 013    | A?        | 000                     |
| 7200 095    |           | 000                     | 7229 424    |           | 0000                    |
| 7200 378    |           | 0000                    | 7232 520 s  | A         | 1                       |
| 7200 665    | A         | 2                       | 7233 170 s  | A,        | 3                       |
| 7200 800    | A,        | 4                       | 7234 688    | A         | 0                       |
| 7201 460    | ,A        | 4                       | 7235 011    | A         | 2                       |
| 7201 728    | A         | 0                       | 7235 658    |           | 000 N                   |
| 7202 485    |           | 1 N                     | 7236 142    |           | 000 N                   |
| 7202 843    |           | 0000                    | 7236 418    | A         | 1                       |
| 7202 138    |           | 0000                    | 7236 695    | A,        | 00                      |
| 7203 135    | A         | 2                       | 7238 216    | A,        | 0000 N                  |
| 7204 577    | A,        | 5                       | 7239 281    | A         | 0000                    |
| 7204 672    |           | 00                      | 7239 765    |           | 0000                    |
| 7205 022    |           | 0000                    | 7240 149    | A         | 1                       |
| 7206 692    | ,A        | 6                       | 7240 883    | A         | 3                       |
| 7207 165    |           | 0000                    | 7241 099    | A         | 2                       |
| 7207 415    |           | 00                      | 7243 750    | A         | 1                       |
| 7207 715    |           | 1                       | 7244 004    | A         | 2                       |
| 7208 079    |           | 0000                    | 7245 152    |           | 00                      |
| 7208 511    |           | 0000                    | 7245 959    | *A        | 2                       |
| 7209 427    |           | 0000                    | 7246 457    |           | 0000                    |

| Wave length  | Substance | Intensity and Character | Wave length  | Substance | Intensity and Character |
|--------------|-----------|-------------------------|--------------|-----------|-------------------------|
| 7247 091     |           | 0000                    | 7277 469     | A         | 000                     |
| 7247 494 s   | A         | 1 N                     | 7277 678     |           | 2 N                     |
| 7248 047     |           | 0000 N                  | 7278 385     | A         | 0 N                     |
| 7249 244     | A         | 0 N                     | 7278 762     | A?        | 000                     |
| 7249 581     |           | 0000                    | 7280 042     | A         | 00 N                    |
| 7250 511     | A         | 1 N                     | 7280 890     | A         | 00 Nd                   |
| 7250 928     |           | 00 N                    | 7281 913     |           | 0000 N                  |
| 7252 032     |           | 000 N                   | 7282 600     | A         | 1 N                     |
| 7252 355     | A         | 0                       | 7283 112     |           | 000 N                   |
| 7252 664     | A         | 2 N                     | 7283 435     | A         | 000                     |
| 7253 137     | A         | 00                      | 7284 107     |           | 0000 N                  |
| 7253 493     | A         | 1                       | 7285 158     |           | 00                      |
| 7254 002     | A         | 1                       | 7285 576     | A         | 000                     |
| 7254 576     |           | 0000                    | 7286 249     |           | 0000 N                  |
| 7254 940     |           | 000                     | 7286 828     |           | 0000 N                  |
| 7255 586     |           | 0000                    | 7287 673 s   | A         | 2 N                     |
| 7256 422     |           | 000                     | 7288 073     | A         | 0000 N                  |
| 7257 392     | A         | 000                     | 7288 416     |           | 1                       |
| 7257 674     |           | 00                      | 7289 049     |           | 00                      |
| 7258 226     | A         | 1 N                     | 7289 466     |           | 0 Nd?                   |
| 7258 939     |           | 0000 N                  | 7290 087     | A         | 00 N                    |
| 7259 357     |           | 0000 N                  | 7290 686 s   | ,A?       | 3 N                     |
| 7259 895     |           | 0000 N                  | 7291 366     | A         | 0 Nd?                   |
| 7260 462     | A         | 000 Nd?                 | 7291 757     | A         | 00                      |
| 7261 028     | A         | 0                       | 7292 025     |           | 0000 N                  |
| 7261 310     |           | 0000                    | 7292 409     | ,A        | 0 N                     |
| 7261 808     | A?        | 00 N                    | 7293 009     | ,A        | 0 N                     |
| 7262 260     | A         | 1                       | 7293 372     | A         | 000 N                   |
| 7262 576     |           | 0000                    | 7293 655     | A         | 00                      |
| 7263 277     | A         | 000                     | 7294 166     |           | 0000 N                  |
| 7263 640     | A         | 0000                    | 7294 651     | A         | 00                      |
| 7264 125     |           | 0000                    | 7295 042     | A         | 000                     |
| 7264 676     | A         | 00                      | 7295 325     | A         | 1                       |
| 7264 892 s   | ,A        | 2                       | 7295 903     | A         | 00 N                    |
| 7265 431     |           | 0000 N                  | 7296 536     | A         | 00                      |
| 7265 868 s   | ,A        | 5                       | 7299 917 } s | A         | 0 N                     |
| 7266 441     |           | 0000 N                  | 7300 226 }   | A         | 1 N                     |
| 7267 101     |           | 0000 N                  | 7300 846     |           | 000 N                   |
| 7268 865     |           | 0000 N                  | 7301 169     |           | 0000                    |
| 7269 566     |           | 0000 N                  | 7301 599     |           | 0000                    |
| 7270 065 } s | A         | 00 N                    | 7301 801     |           | 0000                    |
| 7270 414 }   | A         | 000                     | 7302 394     | A         | 00                      |
| 7273 255 s   | A?,-      | 5 N                     | 7302 906     | A         | 000 N                   |
| 7273 941     |           | 0000 N                  | 7303 162     | A         | 0000                    |
| 7274 952     |           | 0000 N                  | 7303 485     |           | 2                       |
| 7275 675     |           | 2 N                     | 7304 078     |           | 0000 N                  |
| 7276 083     | A         | 000 N                   | 7304 468 s   | ,A        | 3 N                     |
| 7276 581     | A         | 00                      | 7305 195     | A         | 0000 N                  |
| 7276 810     |           | 00                      | 7306 878     |           | 00                      |
| 7277 146     | A         | 00                      | 7307 282     |           | 0000 N                  |



TABLE OF SOLAR SPECTRUM WAVE-LENGTHS 149

| Wave length | Substance | Intensity and Character | Wave length | Substance | Intensity and Character |
|-------------|-----------|-------------------------|-------------|-----------|-------------------------|
| 7308 253    |           | oo Nd?                  | 7316 223    | A         | ooo N                   |
| 7309 047    | A         | 1                       | 7317 112    | A         | oo N                    |
| 7309 788    | A         | 2 N                     | 7317 611    | A         | o N                     |
| 7310 474    | A         | oo                      | 7318 405    | A         | oo                      |
| 7311 403    | -,A       | o Nd?                   | 7319 015    | -,A?      | 1                       |
| 7312 279    |           | oooo                    | 7321 030 s  | A         | 1 Nd                    |
| 7312 911    | A         | 1                       | 7324 249    | A         | 1                       |
| 7313 504    | A         | ooo N                   | 7326 462    |           | o                       |
| 7314 797    | A,-       | ooo                     | 7327 750    | A         | 1                       |
| 7315 416    |           | oooo N                  | 7331 225 s  |           | 1 N                     |
| 7315 834    | A         | o                       |             |           |                         |



# CORRECTIONS AND ADDITIONS TO PROFESSOR H A ROWLAND'S TABLE OF SOLAR SPECTRUM WAVE- LENGTHS

THE errors in wave-length have been carefully determined for the whole table, but the identification of solar lines with the lines of the elements in the spectrum of the electric arc has, at the present time, been carefully revised only from wave-length 3722 to 4175. Therefore the corrections and additions to the identifications have been given only for the more important lines between these limits. A very few small solar lines have been added to the table.

The changes in wave-length have been few, most of the changes in this table being additions to the identifications.

## FIRST PART

|                   |                       |                 |                         | Corrections and Additions |           |                         |
|-------------------|-----------------------|-----------------|-------------------------|---------------------------|-----------|-------------------------|
| Page <sup>1</sup> | Wave length           | Substance       | Intensity and Character | Wave length               | Substance | Intensity and Character |
| 6                 |                       |                 |                         | 2979 410 <sup>4</sup>     |           | o                       |
| 8                 | 2980 080              |                 | o Nd                    | 2980 080 <sup>4</sup>     |           | o Nd                    |
| 8                 | 2983 764              |                 | ooo N                   | 2983 764 <sup>4</sup>     |           | ooo N                   |
| 8                 |                       |                 |                         | 2985 769 <sup>4</sup>     |           | ooo                     |
| 8                 | 2988 333              |                 | ooo N                   | 2988 333 <sup>4</sup>     |           | ooo N                   |
| 8                 | 2988 873              |                 | ooo                     | 2988 873 <sup>3</sup>     |           | ooo                     |
| 8                 |                       |                 |                         | 2989 378 <sup>4</sup>     |           | o                       |
| 9                 | 3003 773 <sup>1</sup> | Ni              | 2 Nd <sup>2</sup>       | 3003 773 <sup>2</sup>     | -, Ni     | 2 Nd <sup>2</sup>       |
| 9                 |                       |                 |                         | 3010 996 <sup>1</sup>     |           | 2 d                     |
| 14                | 3077 295 <sup>5</sup> | Fe              | 3                       | 3077 295 <sup>5</sup>     | Fe        | 3                       |
| 14                | 3077 332 <sup>5</sup> |                 | 1                       | 3077 332 <sup>5</sup>     |           | 1                       |
| 18                | 3138 798              | Zr              | 1                       | 3138 789                  | Zr        | 1                       |
| 21                | 3177 633              | Fe <sup>2</sup> | 2                       | 3177 653                  | Fe?       | 2                       |
| 23                | 3195 705 <sup>5</sup> | Ni              | 2                       | 3195 705 <sup>5</sup>     | Y-Ni      | 2                       |
| 23                | 3200 407              |                 | 2 Nd?                   | 3200 407                  | Y,        | 2 Nd?                   |
| 23                | 3203 435              |                 | 1                       | 3203 435                  | Y         | 1                       |
| 24                | 3216 807              |                 | 1                       | 3216 807                  | Y         | 1                       |
| 25                | 3223 378              |                 | 1                       | 3223 378                  | Mn        | 1                       |
| 26                | 3242 395              |                 | 1                       | 3242 395                  | Y         | 1                       |

<sup>1</sup> The page numbers refer to the reprint of the Table, which will soon be ready for distribution.

FIRST PART — *Continued*

|      |             |              |                         | Corrections and Additions   |              |                         |
|------|-------------|--------------|-------------------------|---|--------------|-------------------------|
| Page | Wave length | Substance    | Intensity and Character | Wave length   | Substance    | Intensity and Character |
| 30   | 3286 784    |              | 0                       | 3286 754  |              | 0                       |
| 30   | 3289 498    |              | 4                       | 3289 498  | Eb?          | 4                       |
| 32   | 3308 947    |              | 5                       | 3308 947  | Co, Ti       | 5                       |
| 32   | 3309 065    | Co, Ti       | 0000 N                  | 3309 065  |              | 0000 N                  |
| 32   | 3312 453    | Co           | 2                       | 3312 453  | Ni           | 2                       |
| 33   | 3328 016    | Di?          | 2                       | 3328 016  | Y            | 2                       |
| 33   | See note to | 3335 192, 33 | 35 350, etc             | See note to   | 3335 299, 33 | 35 350, etc             |
| 35   | 3353 875    |              | 4                       | 3353 875  | Sc,          | 4                       |
| 37   | 3372 901    | Ti-Pd        | 5                       | 3372 901 } d?   | * Ti Pd      | 10                      |
| 37   | 3372 994    |              | 5                       | 3372 994 }  |              |                         |
|      |             |              |                         | * This is probably a strong titanium line which was measured as double, but is probably a single line reversed in the Sun |              |                         |
| 38   | 3385 167    |              | 0                       | 3385 167  | Y            | 0                       |
| 40   | 3407 937    | Di?          | 0                       | 3407 937  | Y            | 0                       |
| 43   | 3443 791    | Co           | 5 d?                    | 3443 791  | Co, Ti       | 5 d?                    |
| 47   | 3496 224    | Co           | 0                       | 3496 224  | Co, Y        | 0                       |
| 53   | 3565 535 s  | Fe           | 20                      | 3565 535 s  | Fe           | 12                      |
| 54   | 3572 712    | , Sc         | 6                       | 3572 712  | Sc,          | 6                       |
| 62   | 3683 182    | Co           | 3                       | 3683 182 } s  | Co           | 3                       |
| 62   | 3683, 229   | Fe-v         | 4                       | 3683 229 }  | Fe V         | 4                       |
| 62   | 3683 761    |              | 2                       | 3683 761  | Fe           | 2                       |
| 63   | 3685 810    |              | 0000                    | 3685 800  |              | 0000                    |
| 63   | 3694 344    |              | 3                       | 3694 344  | Eb?          | 3                       |
| 64   | 3706 175    | Mn           | 6 d?                    | 3706 175  | Ca, Mn       | 6 d?                    |

## SECOND PART

|      |             |           |                         | Corrections and Additions |           |                         |
|------|-------------|-----------|-------------------------|---------------------------|-----------|-------------------------|
| Page | Wave length | Substance | Intensity and Character | Wave length               | Substance | Intensity and Character |
|      | 3722 174    |           | 2                       | 3722 174 <sup>†</sup>     | Fe?       | 2                       |
| 4    | 3725 638    |           | 3                       | 3725 638                  | Fe,       | 3                       |
| 4    | 3727 061    | Mn        | 4d?                     | 3727 061                  | Fe, Ru Mn | 4d?                     |
| 4    | 3727 965    |           | 2                       | 3727 965                  | Fe        | 2                       |
| 4    | 3728 183    |           | 1                       | 3728 183                  | Ru        | 2                       |
| 4    | 3728 813    | Ti-Fe     | 2                       | 3728 813                  | Fe-Ti     | 2                       |
| 4    | 3730 534    | Fe        | 3                       | 3730 534                  | Fe, Ru    | 3                       |
| 4    | 3732 545 s  | Ti Fe-Co  | 6                       | 3732 545 s                | Co, Fe    | 6                       |
| 5    | 3737 059 s  | Ca Mn     | 5                       | 3737 059 s                | Mn Ca     | 5                       |

<sup>†</sup> See remarks at the beginning of this Table

## SECOND PART—Continued

|      |             |           |                         | Corrections and Additions |           |                         |
|------|-------------|-----------|-------------------------|---------------------------|-----------|-------------------------|
| Page | Wave length | Substance | Intensity and Character | Wave length               | Substance | Intensity and Character |
| 5    | 3743 508 s  | Fe        | 6                       | 3743 508                  | Fe-Ti     | 6                       |
| 5    | 3743 626    | Ti        | 2                       | 3743 626                  |           | 2                       |
| 5    | 3745 617    | Ti        | 1                       | 3745 617                  | Ti        | 1                       |
| 5    | 3745 717 s  | Fe        | 8                       | 3745 717 s                | Fe        | 8                       |
| 5    | 3746 058 s  | Fe        | 6                       | 3746 058 s                | Fe        | 6                       |
| 5    | 3746 191    | Ni        | 0                       | 3746 191                  | Ni        | 0                       |
| 6    | 3753 732    | Fe Ti     | 6                       | 3753 732                  | Fe-Ti     | 6 d ?                   |
|      |             |           |                         | 3758 269                  |           | 00                      |
| 6    | 3758 269    |           | 00                      | 3758 375 s                | Fe        | 15                      |
| 6    | 3758 375 s  | Fe        | 15                      |                           |           |                         |
| 6    | 3759 215    | Zr        | 1                       | 3759 215                  | La, C     | 1                       |
| 6    | 3759 297    | La-Fe     | 2                       | 3759 297                  | Fe, C     | 2                       |
| 7    | 3767 493    |           | 1 N                     | 3767 493                  | Ru,-      | 1 N                     |
| 8    | 3787 304    | Fe C      | 1                       | 3787 304                  | C-Fe      | 1                       |
| 8    | 3788 839    |           | 2                       | 3788 839                  | V         | 2                       |
| 9    | 3789 553    | Fe        | 1 N                     | 3789 553                  | Fe,-      | 2 N                     |
| 9    | 3799 934    | V         | 1                       | 3799 934                  |           | 1                       |
| 9    | 3800 046 s  |           | 0                       | 3800 046                  | V         | 0                       |
| 10   | 3804 151    | Fe        | 3                       | 3804 151 s                |           | 3                       |
| 10   | 3804 934    | Fe Cr C   | 2                       | 3804 934                  | Cr C      | 2                       |
| 10   | 3807 681    | Fe        | 6                       | 3807 681                  | V Fe      | 6                       |
| 10   | 3811 945    | Fe        | 2                       | 3811 945                  |           | 2                       |
| 10   | 3812 033    |           | 2                       | 3812 033                  | Fe        | 2                       |
| 11   | 3814 671    | Fe C      | 4                       | 3814 617                  | Co Fe C   | 4                       |
| 11   | 3817 523    | Co Ti C   | 0                       | 3817 523                  | -C        | 0                       |
| 11   | 3824 441    |           | 2                       | 3824 441                  | Fe        | 2                       |
| 12   | 3825 543    |           | 2                       | 3825 543                  | Cr        | 2                       |
| 12   | 3826 555    |           | 1                       | 3826 555                  | Cr        | 1                       |
| 12   | 3827 714    |           | 2                       | 3827 714                  | Fe        | 2                       |
| 12   | 3829 617    | Ti C      | 2                       | 3829 617                  | Fe, Ti C  | 2                       |
| 12   | 3829 728    | Fe-C      | 0                       | 3829 728                  | -C        | 0                       |
| 12   | 3829 822    | li C      | 1                       | 3829 822                  | Mn, Ti C  | 1                       |
| 12   | 3831 002    | Fe        | 2                       | 3831 002                  | C Fe      | 2                       |
| 12   | 3833 026    |           | 3 N                     | 3833 026                  | -Ni       | 3 N                     |
| 12   | 3834 006    | Mn C      | 3                       | 3834 006                  | C Mn Rh   | 3                       |
| 12   | 3836 905    |           | 1                       | 3836 905                  | Zr?, Ti   | 1                       |
| 12   | 3837 277    |           | 2                       | 3837 277                  | Fe        | 2                       |
| 13   | 3843 854    |           | 2                       | 3843 854                  | Co,-      | 2                       |
| 13   | 3845 606    | Co-C      | 8 d ?                   | 3845 606                  | C Co      | 8 d ?                   |
| 13   | 3849 501    | C ?       | 1 N                     | 3849 501                  | C Cr      | 1 N                     |
| 13   | 3849 675    |           | 1                       | 3849 675                  | Cr        | 1                       |
| 13   | 3850 118    | Fe        | 10                      | 3850 118                  | Fe-Cr     | 10                      |
| 14   | 3852 347    | Cr, C     | 1                       | 3852 347                  | Cl, C     | 1                       |
| 14   | 3855 450    | V         | 2                       | 3855 450                  | Cr, V     | 2                       |
| 14   | 3855 547    |           | 1                       | 3855 547                  | C,        | 1                       |
| 14   | 3857 805    | C ?       | 6 d ?                   | 3857 805                  | Cr-C      | 6 d ?                   |
| 14   | 3858 262    |           | 1 N                     | 3858 262                  | -Ti       | 1 N                     |
| 14   | 3860 767    | C-Ni      | 3 N                     | 3860 767                  | Ni, C     | 3 N                     |
| 15   | 3866 577    | C-        | 1                       | 3866 577                  | C-Ti      | 1                       |

## SECOND PART—Continued

|      |             |           |                         | Corrections and Additions |                    |                         |
|------|-------------|-----------|-------------------------|---------------------------|--------------------|-------------------------|
| Page | Wave length | Substance | Intensity and character | Wave length               | Substance          | Intensity and character |
| 15   | 3868 060    | C         | 2                       | 3868 060                  | Fe, C              | 2                       |
| 15   | 3873 065    | C         | 2                       | 3873 065                  | Fe C               | 2                       |
| 16   | 3874 651    |           | 2                       | 3874 651                  | , C <sub>1</sub>   | 2                       |
| 16   | 3876 194    | Fe        | 5                       | 3876 194                  | Fe, V              | 5                       |
| 16   | 3879 331    | C         | 1                       | 3879 331                  | C <sub>1</sub> , C | 1                       |
| 16   | 3883 033    | C         | 1                       | 3883 033                  | C, Ti              | 1                       |
| 16   | 3883 426    | C-        | 2                       | 3883 426                  | C Fe               | 2                       |
| 17   | 3884 748    | Ca        | 1                       | 3884 748                  | Co                 | 1                       |
| 17   | 3885 364    | Fe, Cr    | 2                       | 3885 364                  | Cr                 | 2                       |
| 17   | 3886 568    | V         | 0                       | 3886 568                  | La                 | 0                       |
| 17   |             |           |                         | 3886 704                  | V                  | 000                     |
| 17   | 3886 942    | Cr        | 3                       | 3886 942                  | Cr, Mo             | 3                       |
| 17   | 3889 374    |           | 1Nd?                    | 3889 374                  | , Ba               | 1Nd?                    |
| 17   | 3890 068    |           | 1                       | 3890 068                  | Nd, Ce             | 1                       |
| 17   | 3890 707    |           | 1N                      | 3890 707                  | Nd,                | 1N                      |
| 17   | 3891 918    |           | 0                       | 3891 918                  | Ba                 | 0                       |
| 17   | 3892 069    | Fe        | 4                       | 3892 069                  | Cr, Fe             | 4                       |
| 17   | 3894 165    | Cr        | 3                       | 3894 165                  | Fe, Cr, V?         | 3                       |
| 18   | 3900 681    | T - Fe Zr | 5                       | 3900 681                  | Ti Fe              | 5                       |
| 18   | 3902 002    |           | 3                       | 3902 002                  | Nd                 | 3                       |
| 18   | 3902 114    | Fe        | 1                       | 3902 114                  |                    | 1                       |
| 18   | 3903 090    | Fe, Cr    | 10                      | 3903 090                  | Cr, Fe, Mo         | 10                      |
| 18   | 3903 302    |           | 1                       | 3903 302                  | Cr                 | 1                       |
| 18   | 3903 398    |           | 2                       | 3903 398                  | V-Cr?              | 2                       |
| 18   |             |           |                         | 3904 310                  | V                  | 000                     |
| 18   | 3905 017    |           | 1                       | 3905 017                  | Mn,                | 1                       |
| 18   | 3905 146    |           | 1                       | 3905 146                  | Mn                 | 1                       |
| 18   | 3906 044    |           | 3                       | 3906 044                  | Nd,                | 3N                      |
| 18   | 3907 807    |           | 1                       | 3907 807                  | Fe, Ti?            | 1                       |
| 18   | 3907 910    |           | 1                       | 3907 910                  | Cr, Nd             | 1                       |
| 18   | 3909 976    | Fe        | 5                       | 3909 976                  | Fe, V              | 5                       |
| 18   | 3910 079    | Co-Ca     | 3Nd?                    | 3910 079                  | Ba, Co             | 3Nd?                    |
| 19   | 3913 609    | Ti-Fe     | 5d?                     | 3913 609                  | Li-                | 5d?                     |
| 19   | 3921 105    |           | 0                       | 3921 105                  | Nd                 | 0                       |
| 19   | 3921 188    | Cr-Nd     | 3                       | 3921 188                  | Cr-                | 3                       |
| 19   | 3921 855    | Zr-Mn     | 4                       | 3921 855                  | Ce, Mn-Zr          | 4                       |
| 19   | 3923 180    |           | 1                       | 3923 180                  | Pt, Ce             | 1                       |
| 20   | 3925 347 s  | Co, Fe?   | 4                       | 3925 347 s                | Co, Fe? V          | 4                       |
| 20   | 3928 357    | Cr?       | 2Nd?                    | 3928 357                  | , Mn               | 2Nd?                    |
| 20   | 3929 363    | Fe-La-Mn  | 2                       | 3929 363                  | Fe La Mn Co        | 2                       |
| 20   | 3929 497    | Co?       | 1                       | 3929 497                  |                    | 1                       |
| 20   | 3933 523    |           | 8N                      | 3933 523                  |                    | 8N                      |
| 20   | 3934 108    | Co-       | 8N                      | 3934 108                  | Co, V-Zr           | 8N                      |
| 20   | 3934 174    |           | 0N                      | 3934 508                  | Ti, Cr?            | 0N                      |
| 20   | 3938 439    |           | 2                       | 3938 439                  | , Cr               | 2                       |
| 20   |             |           |                         | *Mostly shading of K      |                    |                         |
| 21   | 3941 323    |           | 1                       | 3941 323                  | Cr, V              | 1                       |
| 21   | 3941 637    | Cr        | 3                       | 3941 637                  | Cr, Nd             | 3                       |
| 21   | 3941 997    |           | 1                       | 3941 997                  | -Mn                | 1                       |

## SECOND PART — Continued

|      |             |           |                         | Corrections and Additions                  |            |                         |
|------|-------------|-----------|-------------------------|--|------------|-------------------------|
| Page | Wave length | Substance | Intensity and Character | Wave length                                | Substance  | Intensity and Character |
| 21   | 3942 157    | Mn?       | oN                      | 3942 157                                   | V-         | oN                      |
| 21   | 3943 721    |           | 1                       | 3943 721                                   | V,-        | 1                       |
| 21   | 3948 818    | Ti        | 4                       | 3948 818                                   | Ti, V      | 4                       |
| 21   | 3951 219    | Cr        | 1                       | 3951 219                                   | Cr, Nd     | 1                       |
| 21   | 3952 103    | Mn        | 2                       | 3952 103                                   | Mn, V      | 12                      |
| 21   | 3952 342    | Na?       | 0                       | 3952 342                                   | Nd         | 0                       |
| 21   | 3952 754    | Fe        | 4                       | 3952 754                                   | Ce Fe      | 4                       |
| 21   | 3952 894    |           | 0                       | 3952 894                                   | Mn, Nd?    | 0                       |
| 21   | 3953 043    | Mn        | 3                       | 3953 043                                   |            | 3                       |
| 21   |             |           |                         | * This V line weak in VCl from Troms-dorff |            |                         |
| 22   | 3955 524    |           | 00                      | 3955 624                                   |            | 00                      |
| 22   | 3956 476    | Co, Ti    | 4                       | 3956 476                                   | Ce, Co Ti  | 14                      |
| 22   | 3958 355    | Ti, Zr    | 5                       | 3958 355                                   | Zr, Ti, Ce | 5                       |
| 22   | 3959 972    |           | 1                       | 3959 972                                   | Ce,-       | 1                       |
| 22   | 3964 663    | Fe        | 3                       | 3964 663                                   | Ce Fe      | 3                       |
| 22   | 3964 897    | Fe?       | 0 Nd?                   | 3964 897                                   |            | 0 Nd?                   |
| 22   | 3966 647    | Ni, Fe    | 2                       | 3966 647                                   |            | 2                       |
| 22   | 3966 778    | Fe        | 3                       | 3966 778                                   | Fe, Zr     | 3                       |
| 22   | 3968 350    |           | 6 N                     | 3968 350                                   | -, Zr      | 6 N                     |
| 22   | 3968 854    | Fe?       | 1 N                     | 3968 854                                   |            | 1 N                     |
| 22   |             |           |                         | * Ce and Co a faint side line              |            |                         |
| 22   |             |           |                         | * Mostly shading of H                      |            |                         |
| 23   | 3968 886    |           | 6 N                     | 3968 886                                   |            | 6 N                     |
| 23   | 3970 419    |           | 1                       | 3970 419                                   | Fe?        | 1                       |
| 23   | 3970 540    |           | 2                       | 3970 540                                   | Fe         | 2                       |
| 23   | 3970 631    |           | 1                       | 3970 631                                   | Ni         | 1                       |
| 23   | 3973 262    | Co        | 1                       | 3973 262                                   |            | 1                       |
| 23   | 3973 796    | Fe        | 1                       | 3973 796                                   | Nd, V, Fe  | 31                      |
| 23   | 3974 536    | Fe        | 3                       | 3974 536                                   | Fe, Ni     | 3                       |
| 23   | 3974 637    | Ni?       | 2                       | 3974 637                                   |            | 2                       |
| 23   | 3975 506    | Co        | 1                       | 3975 506                                   | Rh Co, V?  | 1                       |
| 23   | 3977 009    | Fe        | 2                       | 3977 009                                   | Nd Fe      | 2                       |
| 23   | 3978 809    | Co, Cr    | 3                       | 3978 809                                   | Co, Cr, Ce | 3                       |
| 23   | 3979 664    | -, Co     | 4                       | 3979 664                                   | Nd Co      | 4                       |
| 23   |             |           |                         | * Mostly shading of H                      |            |                         |
| 23   |             |           |                         | * V line weak in VCl                       |            |                         |
| 24   | 3981 662    |           | 00                      | 3981 662                                   | -, Zr?     | 00                      |
| 24   | 3981 762    | Zi?       | 0                       | 3981 762                                   |            | 0                       |
| 24   | 3982 630    | Ti Mn     | 2                       | 3982 630                                   | Ti         | 2                       |
| 24   | 3982 742    | Y         | 3                       | 3982 742                                   | Mn Y       | 3                       |
| 24   | 3983 341    |           | 2 N                     | 3983 341                                   | -, Cr      | 2 N                     |
| 24   | 3985 385    |           | 0                       | 3985 385                                   | Mn         | 0                       |
| 24   | 3985 463    | Mn        | 1                       | 3985 463                                   |            | 1                       |
| 24   | 3985 539    | Fe        | 5                       | 3985 539                                   | Fe         | 3                       |
| 24   | 3986 321    | Fe        | 3                       | 3986 321                                   | Fe Nd      | 3                       |
| 24   | 3988 114    |           | 0                       | 3988 114                                   | Eb?        | 20                      |
| 24   | 3990 129    | Cr-Mn     | 1                       | 3990 129                                   | Mn Cr      | 1                       |
| 24   | 3991 690    | Co        | 0                       | 3991 690                                   | Co Mn      | 0                       |

## SECOND PART—Continued

|      |              |                 |                         | Additions and Corrections  |                      |                         |
|------|--------------|-----------------|-------------------------|--|----------------------|-------------------------|
| Page | Wave lengths | Substance       | Intensity and Character | Wave lengths   | Substance            | Intensity and Character |
| 24   | 3991 830     | Co Cr           | 2                       | 3991 830   | Ci, Co               | 2                       |
| 24   | 3992 538     | Fe              | 1                       | 3992 538   | Fe, Ce               | 1                       |
| 24   | 3994 092     | Ci              | 1                       | 3994 092   | Ni <sup>2</sup>      | 1                       |
| 24   | 3994 160     | Ni              | 1                       | 3994 160   | Cr                   | 1                       |
| 24   |              |                 |                         | <sup>2</sup> There is a strong metallic line at 3988 140, which is supposed to be due to erbium, but it is probably not coincident with the solar line |                      |                         |
| 25   | 4001 315     |                 | 3                       | 4001 315   | Mn,                  | 3                       |
| 25   | 4005 202     |                 | 1                       | 4005 202   | Fe                   | 1                       |
| 25   | 4005 632     |                 | 1                       | 4005 632   | Fe                   | 1                       |
| 25   | 4005 856     |                 | 3                       | 4005 856   | V                    | <sup>1</sup> 3          |
| 25   |              |                 |                         | <sup>1</sup> This V line is weak in VCl from Fromsdorff  |                      |                         |
| 26   | 4009 694     | Fe              | 1                       | 4009 694   |                      | 1                       |
| 26   | 4010 327     | Fe              | 1                       | 4010 327   | Ce Fe                | 1                       |
| 26   | 4012 541     | Ti              | 4                       | 4012 541   | Li, Ce               | 4                       |
| 26   | 4017 620     | Ni <sup>2</sup> | 2                       | 4017 620   |                      | 2                       |
| 27   | 4021 057     | Co              | 3                       | 4021 057   | Nd Co                | 3                       |
| 27   | 4021 893     | Li              | 0                       | 4021 893   | Nd                   | 0                       |
| 27   | 4022 018     | Fe              | 5                       | 4022 018   | Li Fe-V              | 5 d?                    |
| 27   | 4023 533     | Co              | 3                       | 4023 533   | V, Co                | <sup>2</sup> 3          |
| 27   | 4025 286     | Ti              | 3                       | 4025 286   | Ti Ce                | 3                       |
| 27   | 4028 497     | Ti              | 4                       | 4028 497   | Fe-Ce                | 4                       |
| 27   | 4028 912     | Fe Ce           | 1                       | 4028 912   | Fe                   | 1                       |
| 27   | 4030 646     | Fe Ti           | 5                       | 4030 646   | Nd Fe-Li             | 5                       |
| 27   | 4030 878     | Mn              | 4                       | 4030 878   |                      |                         |
| 27   | (4030 918)   | Mn              | 5                       | (4030 918)   | Mn                   | <sup>3</sup> rod?       |
| 27   | 4030 947     |                 |                         | 4030 947   |                      |                         |
| 27   | 4031 048     |                 | 2                       | 4031 048   | Fe <sup>2</sup>      | 2                       |
| 27   | 4031 865     | Fe La           | 2                       | 4031 865   | La,                  | 2                       |
| 27   | 4031 942     | Mn              | 2                       | 4031 942   | Fe?, Nd, Mn, V       | 2                       |
| 27   | 4033 224 s   | Fe Mn           | <sup>1</sup> 7 d?       | 4033 224 s   | Mn                   | <sup>3</sup> 8 d?       |
| 27   | 4033 337     |                 | 1                       | 4033 337   | Fe?                  | 1                       |
| 27   |              |                 |                         | <sup>2</sup> V line weak in VCl from Fromsdorff  |                      |                         |
| 27   |              |                 |                         | <sup>3</sup> Apparent duplicity caused by reversal in Sun  |                      |                         |
| 28   | 4034 644 s   | Mn Fe           | <sup>1</sup> 6 d?       | 4034 644 s   | Mn                   | <sup>2</sup> 6 d        |
| 28   | 4036 923     |                 | 1                       | 4036 923   | V,                   | 1                       |
| 28   | 4037 837     |                 | 1                       | 4037 837   | Ce,                  | 1                       |
| 28   | 4043 839     |                 | 0                       | 4043 839   | Cr                   | 0                       |
| 28   | 4043 956     | Ci              | 0                       | 4043 956   | Li                   | 0                       |
| 28   | 4044 644     |                 | 1                       | 4044 644   | , Zr                 | 1                       |
| 28   | 4045 371     | Mn              | 1 N                     | 4045 371   | Ce, Mn               | 1 N                     |
| 28   | 4045 748     |                 | 2                       | 4045 748   | , Zr, W <sup>2</sup> | 2                       |
| 28   | 4047 338     | K <sup>2</sup>  | oo Nd?                  | 4047 338   | K                    | oo d                    |
| 28   | 4047 461     | Fe              | 2                       | 4047 461   | Ce-Fe                | 2                       |
| 28   | 4048 224     |                 | 1 N                     | 4048 224   | Cr                   | 1 N                     |



SECOND PART — *Continued*

|      |                       |                    |                         | Corrections and Additions  |                          |                         |
|------|-----------------------|--------------------|-------------------------|--|--------------------------|-------------------------|
| Page | Wave length           | Substance          | Intensity and Character | Wave length  | Substance                | Intensity and Character |
| 28   |                       |                    |                         | <sup>a</sup> Apparent duplicity caused by reversal in Sun  |                          |                         |
| 29   | 4049 822              |                    | 1 Nd ?                  | 4049 882   | -, C <sub>1</sub>        | 1 Nd ?                  |
|      | 4052 603              | Mn                 | 2                       | 4052 603   | Mn, Fe                   | 2                       |
|      | 4052 650              | Fe                 | 3                       | 4052 650   |                          | 3                       |
|      | 4053 981              | Fe Ti              | 3                       | 4053 981   | Cr Fe-Ti                 | 3                       |
|      | 4054 962              |                    | 2                       | 4054 962   | Fe                       | 2                       |
|      | 4055 189              | Ti Fe              | 3                       | 4055 189   | Ce Ti Fe, Z <sub>1</sub> | 3                       |
|      | 4058 372              | Co Fe              | 4                       | 4058 372   | Ti, Co Fe                | 4                       |
| 29   | 4061 881              | Mn                 | <sup>1</sup> { 2 Nd     | 4061 781   | Mn                       | <sup>1</sup> 2 Nd       |
| 29   | 4062 105              |                    | 2                       | 4062 105   |                          | 2                       |
| 30   | 4064 361              | Ti                 | 1                       | 4064 361   | Zr Ti                    | 1                       |
| 30   | 4067 139              | Fe                 | 5                       | 4067 139   | Cr Fe                    | 5                       |
| 30   |                       |                    |                         | 4068 555   | Cr                       | 000                     |
| 30   | 4069 761              |                    | 1                       | 4069 761   | V,-                      | 1                       |
| 30   | 4071 680              | Fe                 | 1                       | 4071 680   | Fe, V                    | 1                       |
| 30   | 4072 295              |                    | 00 N                    | 4072 295   | , V?                     | <sup>2</sup> 00 N       |
| 30   | 4073 921 <sup>5</sup> | Fe                 | 4                       | 4073 921   | Ce, Fe                   | 4                       |
| 30   | 4078 515              | Fe                 | 4                       | 4078 515   | Zr Fe                    | 4                       |
| 30   |                       |                    |                         | <sup>a</sup> This line is probably variable in the solar spectrum  |                          |                         |
| 31   | 4080 368              | Fe, Nd             | 3                       | 4080 368   | Fe, Nd, C <sub>1</sub>   | 3                       |
| 31   | 4081 415              | Fe                 | 1                       | 4081 415   |                          | 1                       |
| 31   | 4083 095              | Mn                 | 4                       | 4083 095   | V Mn                     | 4                       |
| 31   |                       |                    |                         | 4084 300   | Cr                       | 000                     |
| 31   | 4085 408              |                    | 1                       | 4085 408   | -, Ce                    | 1                       |
| 31   | 4086 133              |                    | 1                       | 4086 133   | Fe?                      | 1                       |
| 31   | 4091 109              |                    | 3                       | 4091 109   | Ce                       | 3                       |
| 31   | 4092 547              | Co, Mn             | 3                       | 4092 547   | Co, Mn, V                | 3                       |
| 31   | 4092 821              | <sup>1</sup> V, Ca | 3 d?                    | 4092 821   | <sup>1</sup> V, Ca       | 3 d?                    |
| 31   |                       |                    |                         | <sup>a</sup> These lines coincide with the heads of bands due to calcium. The bands probably become lines owing to the weak dilution of calcium vapor in the Sun |                          |                         |
| 32   | 4096 262              | Fe                 | 2                       | 4096 262   | Fe, Nd                   | 2                       |
| 32   | 4098 689              | <sup>1</sup> Ca?   | 4                       | 4098 689   |                          | 4                       |
| 32   | 4098 746              |                    | 2                       | 4098 746   | <sup>1</sup> -, Co?      | 2                       |
| 32   |                       |                    |                         | 4101 531   |                          | 000                     |
| 32   | 4101 840              |                    | 3                       | 4101 840   | Fe?                      | 3                       |
| 32   |                       |                    |                         | 4105 019   | Cr                       | 000                     |
| 32   | 4107 649 <sup>5</sup> | Ce Fe / 1          | 5                       | 4107 649 <sup>5</sup>  | Ce-Fe                    | 5                       |
| 32   | 4109 905              | <sup>1</sup> V     | 2                       | 4109 905   | V                        | <sup>2</sup> 2          |
| 32   |                       |                    |                         | <sup>a</sup> One of the strongest Vanadium lines   |                          |                         |
| 33   | 4111 021              | Mn                 | 1                       | 4111 021   | , Mn                     | 1                       |
| 33   | 4111 154              | Mn?                | 1                       | 4111 154   |                          | 1                       |
| 33   | 4116 707              | <sup>1</sup> V     | 0                       | 4116 707   | V, Fe?                   | 0                       |
| 33   | 4116 859              | Nd?                | 1                       | 4116 859   |                          | 1                       |
| 33   | 4116 974              |                    | 00                      | 4116 974   | Nd?                      | 00                      |

## SECOND PART—Continued

|      |  |                    |                         | Corrections and Additions  |                     |                         |
|------|--|--------------------|-------------------------|--|---------------------|-------------------------|
| Page | Wave length  | Substance          | Intensity and Character | Wave-length  | Substance           | Intensity and Character |
| 33   | 4119 550   | Fe                 | 1                       | 4119 550   | C <sup>2</sup> Fe V | 1                       |
| 33   | 4123 384   | <sup>2</sup> La    | 12                      | 4123 384   | <sup>2</sup> La     | 1                       |
| 33   | 4123 539   | V                  | 0                       | 4123 539   | Ci                  | 0                       |
| 33   | 4123 664   | Mn                 | 1                       | 4123 664   | Ce, V Mn            | 1                       |
| 34   | 4126 200   | V                  | 000                     | 4126 200   |                     | 000                     |
| 34   | 4126 344   | Fe                 | 4                       | 4126 344   | V Fe                | 4                       |
| 34   | 4127 957   | Fe                 | 4                       | 4127 957   | Ce-Fe               | 4                       |
| 34   | 4128 251   | V                  | 6 d                     | 4128 251   | Ce-V,               | 6 d                     |
| 34   | 4131 271   | Mn                 | 1                       | 4131 271   | Ce, Mn              | 1                       |
| 34   | 4132 235   | Fe                 | 10                      | 4132 235   | Fe-Co               | 10                      |
| 34   | 4134 589   | V Fe?              | 3                       | 4134 589   | Fe?                 | 3                       |
| 34   | 4134 675   |                    | 1                       | 4134 675   | V                   | 1                       |
| 35   | 4137 809   | Fe, Ce             | 1                       | 4137 809   | Cc                  | 1                       |
| 35   | 4140 400   | Fe?                | 0                       | 4140 400   |                     | 0                       |
| 35   | 4140 558   |                    | 3                       | 4140 558   | , Fe?               | 3                       |
|      | 4141 809   | La                 | 0                       | 4141 809   | , La                | 0 N                     |
|      |  |                    |                         | 4141 910   | La                  | 000 0                   |
| 35   | 4143 664   |                    | 2                       | 4143 664   | , Mo                | 2                       |
| 35   | 4147 645   | Mn                 | 1                       | 4147 645   |                     | 1                       |
| 35   | 4147 677   |                    | 000                     | 4147 677   | Mn                  | 00                      |
| 35   | 4149 360   | Zr                 | 2                       | 4149 360   | C, Zr               | 2                       |
| 36   | 4150 964   | Ce                 | 00N                     | 4150 964   |                     | 00N                     |
| 36   | 4151 129   | Zr, Ti             | 1                       | 4151 129   | Ce-Zi, Ii           | 1                       |
| 36   | 4152 108   | Fe, La             | 2                       | 4152 108   | Fe, I a, Cc         | 2                       |
| 36   | 4152 242   | Ce?                | 1                       | 4152 242   |                     | 1                       |
| 36   | 4154 265   |                    | 2                       | 4154 265   | , Fe?               | 2                       |
| 36   | 4162 623   |                    | 1N                      | 4162 623   | C, -                | 1N                      |
| 37   | 4162 825   |                    | 1N                      | 4162 825   | Ce, C               | 1N                      |
| 37   | 4163 818   | li, Cr             | 4                       | 4163 818   | Cr li,              | 4                       |
| 37   | 4165 550   | Fe                 | 3d?                     | 4165 550   | C, Fe               | 3d                      |
| 37   | 4165 759   | Ce,-               | 2                       | 4165 759   | , Ce                | 1                       |
| 37   | 4167 737   |                    | 1Nd?                    | 4167 737   | Y Ru?               | 1Nd?                    |
| 37   | 4168 025   |                    | 2                       | 4168 025   | Ce-Fe               | 2                       |
| 37   | 4168 133   | Ni                 | 2                       | 4168 133   | Ni, C               | 2                       |
| 37   | 4171 854 <sup>1</sup>  | Cr, La, Mn, Ni, Fe | 2                       | 4171 854   | C, Fe?              | 2                       |
| 37   | 4172 211   | Al?                | 1                       | 4172 211   | Al                  | 1                       |
| 37   | 4172 296   | Fe                 | 2                       | 4172 296   | Fe Ce               | 2                       |
| 37   | <sup>1</sup> Probably due to some common impurity of unknown origin or Si? The gallium line is in this region, but I have no specimen of gallium with which to determine its exact position. The Fe line is strong enough alone to account for it. |                    |                         | <sup>2</sup> Note at bottom of page 37 should be struck out. The line is not wholly due to carbon (or cyanogen). |                     |                         |
| 38   | 4177 698   | Fe                 | 3                       | 4177 698   |                     | 3                       |
| 38   | 4177 772   |                    | 3                       | 4177 772   | Fe*                 | 3                       |
| 40   | 4207 566   | Fe                 | 1N                      | 4207 566   | (                   | 1N                      |

\*See remarks at the beginning of this table

SECOND PART—*Concluded*

|      |  |           |                         | Corrections and Additions   |           |                         |
|------|--|-----------|-------------------------|---|-----------|-------------------------|
| Page | Wave length                            | Substance | Intensity and Character | Wave length   | Substance | Intensity and Character |
| 41   | 4233 328                               | Mn-Fe     | 4                       | 4233 328  | Mn        | 4                       |
| 42   | 4239 890                               | Mn        | 3                       | 4239 890  | Fe, Mn    | 3                       |
| 42   | 4246 996                               | Y?        | 5                       | 4246 996  | * Sc      |                         |
|      |  |           |                         | * One of the strongest lines in the spectrum of scandium                                    |           |                         |
| 45   | 4280 027                               |           | 1                       | 4280 027  | Fe,       | 1                       |
| 45   | 4280 374                               |           | 1                       | 4280 374  | , Fe      | 1N                      |
| 45   | 4285 966                               |           | 1                       | 4285 966  | Co        | 1                       |
| 45   | 4288 310                               | Ti        | 1                       | 4288 310  | 11, Fe    | 1                       |
| 46   | 4299 803                               | Ti        | 2                       | 4299 803  | Fe, Ti    | 2                       |
| 46   | 4304 729                               |           | 2                       | 4304 729  | Fe,       | 2                       |
| 56   | 4455 980                               | Mn        | 2                       | 4455 980  | Mn        | 2                       |
| 56   | 4456 064 s                             | Ca        | 3                       | 4456 064 } s  | Ca        | 3                       |
| 56   | 4459 525                               | Fe, Cr    | 1                       | 4459 525  | Ci        | 1                       |
| 57   | 4464 938                               |           | 1                       | 4464 938  | Fe        | 1                       |
| 58   | 4482 338                               | , Fe      | 5                       | 4482 338  | Fe,       | 5                       |
| 59   | 4497 023 s                             | Cr        | 3                       | 4497 023 } s  | Cr        | 3                       |
| 59   | 4497 138                               | Zr        | 0                       | 4497 138 } s  | Zr        | 0                       |
| 59   | 4501 448                               | 11,       | 5                       | 4501 445  | Ti,       | 5                       |
| 62   | 4546 129                               | Fe, Cr    | 3                       | 4546 129  | Ci        | 3                       |
| 80   | 4914 150                               |           | 2                       | 4914 150  | Ni        | 2                       |
| 81   | 4934 214 } s                           | Ba        | 3                       | 4934 214 } s  | Ba Fe ?   | 6                       |
| 81   | 4934 277 } s                           |           | 4                       | 4934 277 } s  |           |                         |
|      |  |           |                         | * This is probably a barium line with another narrower line (probably iron) at the red edge |           |                         |
| 92   | 5209 779                               |           | 0000                    | 5209 779  |           | 0000                    |
| 96   | 5328 696                               | Fe        | 2                       | 5328 696  | } * Fe    | 5                       |
| 96   | 5328 696                               | Fe        | 2                       | 5328 696  | } * Fe    | 5                       |
|      |  |           |                         | * Measured as double, but probably reversed in Sun  |           |                         |
| 109  | 5646 039                               |           | 00                      | 5646 049  |           | 00                      |
| 110  | 5682 427                               |           | 2                       | 5682 427  | Ni        | 2                       |
| 111  | 5693 330                               |           | 0000                    | 5693 350  |           | 0000                    |
| 113  |  |           |                         | 5754 222  | A ?       | 000                     |
| 114  | 5788 990                               | A (O)     | 00                      | 5788 983  | A (O)     | 00                      |
| 114  | 5789 418 *                             | A (O)     | 00                      | 5789 415 *  | A (O)     | 00                      |
| 118  |  |           |                         | 5889 972  | A (wv)    | 1N                      |
| 118  | 5896 155                               | Na        | 20                      | 5896 155 D <sub>1</sub> s <sup>3</sup>  | Na        | 20                      |
| 118  | 5896 35 D <sub>71</sub> s <sup>3</sup> |           | 00N                     | 5896 357  |           | 00N                     |
| 120  | 5918 635                               | A (wv)    | 4                       | 5918 635  | A (wv)    | 4d                      |
| 122  | 5974 094                               | N         | 0000                    | 5974 094  |           | 0000N                   |
| 122  | 5974 812                               | N         | 0000                    | 5974 812  |           | 0000N                   |
| 126  | 6090 429                               | Fe        | 2                       | 6090 429  | Ti, V     | 2                       |
| 129  | 6252 773 s                             |           | 7                       | 6252 773 s  | Fe        | 7                       |
| 131  | 6298 666                               | Co, A (O) | 2                       | 6298 666  | Ni, A (O) | 2                       |
| 136  | 6609 360 s                             |           | 3                       | 6609 360 s  | Fe        | 3                       |
| 146  | 7140 568                               | A         | 000N                    | 7140 560  | A         | 000N                    |